OD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

INDO-PACIFIC FISHERIES COUNCIL

PROCEEDINGS

8th SESSION

COLOMBO

CEYLON

6—22 December 1958

SECTION II

IPFC Secretariat, FAO Regional Office
for Asia and the Far East
Bangkok
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ELIMINARY REPORT ON TRANSPORTATION OF *CHANOS* FINGERLINGS WITH AERATING SYSTEM

by

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ABSTRACT

In connection with the urgent problem relating to the distribution of *Chanos* rlings, experiments on transportation have been carried out using an aerator-pump, ered by an automobile battery.

The results of seven experiments are shown in Table 1.

At a ratio 1:10, in lot A, as many as 978 to 1,086 fingerlings of 50 to 70 mm. in tins 20 l. of water, and 705 to 832 larger fingerlings of 60 to 95 mm. with 30 l. of water, transported with a better survival rate. The rate of mortality in lot A, varied respectively 0 to 14.5% to 60.4 to 73.2% in lot B.

The physical condition of the fish before shipment, which depends on the prepa- y treatment, is of great importance in determining the results of *Chanos* transportation.

Transportation in ordinary fish tins, equipped with areator-pumps and in conjunction a cooling technique, should meet the demand for a simple, economical and safer *os* transportation.

INTRODUCTION

Jnlike *Chanos* fry (ca. 1.5 cm.), which transported easily over more than 1,000 tance fingerlings with the size of 30 to ., are the most difficult to transport. The ical and safe transportation of the fish in group is by means of live fish boats as is one commercially in the Philippines al H.R., Montalban H.R. and Villaluz 951) or by other methods as described by and M. Tjiptoaminoto in their paper Transportation of *Chanos* fingerlings and ortality" (IPFC/C58/TECH 18). But the tion of this method is restricted to certain where water ways are available. Such re rare in Indonesia, so that the necessity sportation by land has been felt since long. as become urgent as in the last few years ious tambak centers, nursery ponds for ying fingerlings, have been set up diredja, R., 1957).

Various experiments were recently con- by the local Fisheries Services at Central st Java. Fingerlings in ordinary fish tins transported in trucks or "pick-ups". s obtained in Central Java are worth ming. On five different occasions only 125-250 fingerlings measuring 30-120 mm. were transported in tins containing 30-60 l. of water (in 2½-14 hours). The rate of mortality varied from 0-16% (Administrative Report, Central Java).

Transportation of *Chanos* fingerlings by land is proved to be a very risky job and needs experienced personnel for its operation. The transportation of a low number of fish, which is meant to prevent heavy losses, is uneconomical.

In the first stage, the experiments on the use of this aerating system, are aimed to find out the improvement in the number of fish carried per unit of water and the rate of mortality.

METHODS

Aerator-pump and Fish Containers. As an ordinary aerator-pump furnished with a power converter is hard to obtain, a second-hand automobile fuel pump is used for this purpose. This "pump" mounted to the dashboard of a jeep, is directly connected to the automobile battery. Actually this apparatus is not very suitable for this job, as it quickly gets warm. But under the present situation is may meet the needs of the common farmer. The use of a paired set and a cooling-system to lower the temperature is advisable.

The capacity varies from ca. 1,500 to 2,000 cc. per minute, and it can be used to a depth of ca. 1.20 m. Each pump is enough for 2 to 4 fish cans.

Ordinary fish containers, provided with a tubing-system of copper and rubber, as seen in Fig. 1, were used in the experiments. During operation the air from the pump is led to the containers through rubber tubes (Fig. 2). The sprayers are made of rattan.

Transportation. These experiments were conducted at the Kamal Brackish-water Experimental Station (Djakarta). On each occasion, two fish tins were used; one was provided with an aerating system, while the other one was not. For this purpose a Willys Jeep was used.

The experiments have been conducted within 3—6 hours as local distribution needs only a few hours. On poor roads, as is usually met in "tambak" areas, a distance of 100—300 km. may be covered within this time.

The fish used in both tins came from the same origin. The treatment, environment and the conditions before transit must be similar.

The tins were filled with 20 or 30 l. water. As long as the water in the nursery ponds, where the fishes came from, was clear, this water was used, sometimes mixed with fresh water from a well near the place.

One to two days before transportation, the fishes were confined in a small compartment (30 m.^{2}), called catching pond. The purpose of this is to empty the guts of the fishes, so that during transit the water remains unspoilt by their excreta. Different stages of treatment of the fishes such as confining, catching, counting, measuring and weighing, etc., have to be done with the utmost care.

Transportation was always conducted during the coolest part of the day e. g. early in the morning. To keep the temperature of the water down, as much as 2—6 kg. of chunks of ice were used. To avoid sudden change in temperature, 2 kg. were used each time, and if the ice melted after a course of time (usually 1—2 hours) another 2 kg. were added.

For one unit of water, measurement in fish weight was adopted. Differences in numbers as seen in Table 1, were caused by this method. Counting and measuring of these active fishes take up much time, by which time the might be harmed. For this reason all the important for the experiments (like recor data etc.,) were done after the operations

The aerator-pump was switched soon as the fish containers were put into t Beside observing the behavior and the co of the fishes, samples of the water were every one hour, for analysis. Also, water s have been taken from the catching po from the tins before introduction of th Table 2 contains the data obtained fr observations. After transportation the fis released again into the same catching The following day the fish were check mortality.

DISCUSSION AND RESULTS

Chanos a fish originating from the sea, is known to be a very active fish jumping habits, their moving behavior the incoming current and other instar wildness when disturbed, make it easy f to get damaged. In the containers, hundreds of fingerlings are confined in limited space, the fishes move turbulently In case of fry, people are aware of the ne of keeping them in complete darkness stored or transported. Only healthy fing are capable of withstanding the sudden from the open body of water to the limite in tins. The physical condition of the f be moved, is an important factor for suc transportation. Preparatory work has th done very carefully. Variable results in t of mortality of fishes, in tins with simil weight, conditions and treatment, are caused by the variability in the physical tions of the fishes before transportation.

The following items must be tak account:

1. Storage before transportation. tioned above, the fish must be c to empty their guts. One or t are considered to be enough. experiments in a 30 m.^{2} pond as 1,000—3,000 fish were c There should be sufficient during confining.
2. Catching must be done with in current of the tide. This possible during high tide. W

is not possible, because of the absence of tides, some ponds must be reserved for the purpose. The existing method of the farmers of catching by means of bamboo screen and seine, while water is insufficient, may cause undesirable excess of fish. In flowing water, the fish, which may gather in front of the sluice gate, are easily caught with a small dip net.

he fish were usually not directly intro- nto the containers, but were kept in y made bamboo baskets or in a net, ut at a suitable place, with flowing water. g measuring, weighing, etc. took place . Everything must be done quickly but eat care.

he author is of the opinion, that heavy f the *Chanos* fingerlings during transpor- s mainly caused by unfavorable factors ly found in the brackish water areas, s high temperature, intense heat, high , absence of continuous flow, etc. (com- ith those in fresh water).

n general, with live-fish transportation it wn that the optimum number of fish s on the volume of water, length of time distance, weight and size of the fish, oxygen supply and temperature. Thus vident that many factors are connected transportation and to solve all this, nents must be made.

In the first stage, the subject of this nent is only to find out whether or not s improvement in the total number per water, for this is the only practical n.

he concentration of dissolved oxygen s on the temperature and salinity. The the temperature and salinity, the lower ncentration and this will coincide with the e in the rate of metabolism of the fishes lves.

Within the limits of practical considera- temperature as well as salinity of the were kept as low as possible. The data le 2 show variability in temperature and n contents, which were examined every ur.

Transportation tests as mentioned above, onducted early in the morning, when air ater (in the storage pond) temperature varied respectively from 24-28°C and 26-28.5°C. Chunks of ice (2 kg.) were directly used as soon as the fish were introduced, to keep down the temperature; sudden change of more than 3°C was always prevented. At the end of the experiment the water temperature in the tins was maintained at 25—28°C, while the air temperature outside was 28—31°C.

It is necessary to acclimatize the fingerlings before releasing them into the ponds, where the temperature is much higher by this time.

On seven occasions the salinity in the catching pond, where the fingerlings were confined, varied from 10—16 part per thousand (measured by a hydrometer). On account of this, the salinity was reduced (except in the last experiment) to as low as 5—7 p.p.m. It has been learned from experiences that direct dropping in salinity down to 10 p.p.m., do not much affect the *Chanos*. Ganapati, *et al* (1950 9—14) in their experiment on "acclimatization in transit" diluted on each occasion within above-mentioned limits (maximum drop of chlorinity 950 p.p. 100,000) except in one case (1370 p.p. 100,000).

The oxygen contents are shown in Table 2. It ranged in lot A (aerated) at a ratio of 1:15 from 1.4—6.2 per l. and in lot B (not aerated) from 0.9—2.2; and at a ratio of 1:10 in lot A from 0.6—6.2 mg./l. against 0.5—2.1 in lot B. From these figures it will be evident that there were distinct differences in the contents of oxygen in both tins. It will be noted here, that samples have not been taken at the time when the fish showed severe signs of distress. The oxygen threshhold and the rate of metabolism of *Chanos* have so far not yet been studied. It appeared that the metabolic rate was high compared with other fresh water species, for death often occured in the first hour (in lot B).

During transportation of fresh water fish, people stir the water with their hands when they stop walking, or agitate it while walking (by shaking the yoke, the water in the buckets will also shake). By so doing, diffusion of oxygen into the water will be stimulated. The water in tins provided with an aerator has the effect as though it is stirred continuously, even if the car stops for some reasons. When this happened to lot B (without aerator) the fish suffered within a short time (5—15 minutes).

The pH in Table 2 varied from 6.7-7.2 in lot B. The carbon dioxide variations (not determined in experiments V, IV, VII) and also the alkalinity are listed in the table.

Table 1 contains data on ratio of fish-weight to volume of water, number and size of the fish, time and distance, mortality etc.

	Ratio weight in kgs. to vol. of water in l.	Size (mm.)	Time (hrs.)	Mortality (%)
A	1 : 15	55 — 90	5 — 5½	0 — 0.9
B	1 : 15	55 — 95	4 — 5½	0 — 15.5
A	1 : 10	50 —120	4 — 5	0 — 14.5
B	1 : 10	53 — 70	4 — 5	60.5 — 73.2

It is obvious that the use of an aerator is preferable to the other method, on account of the rate of mortality. One kg. of fish per 10 l. of water in lot B proved to be too much, whereas in lot A the rate of mortality is about similar to that in lot B on a ratio of one kg. in 15 l. of water. Transportation of one kg. *Chanos* fingerlings in 15 l. of water can be done safely.

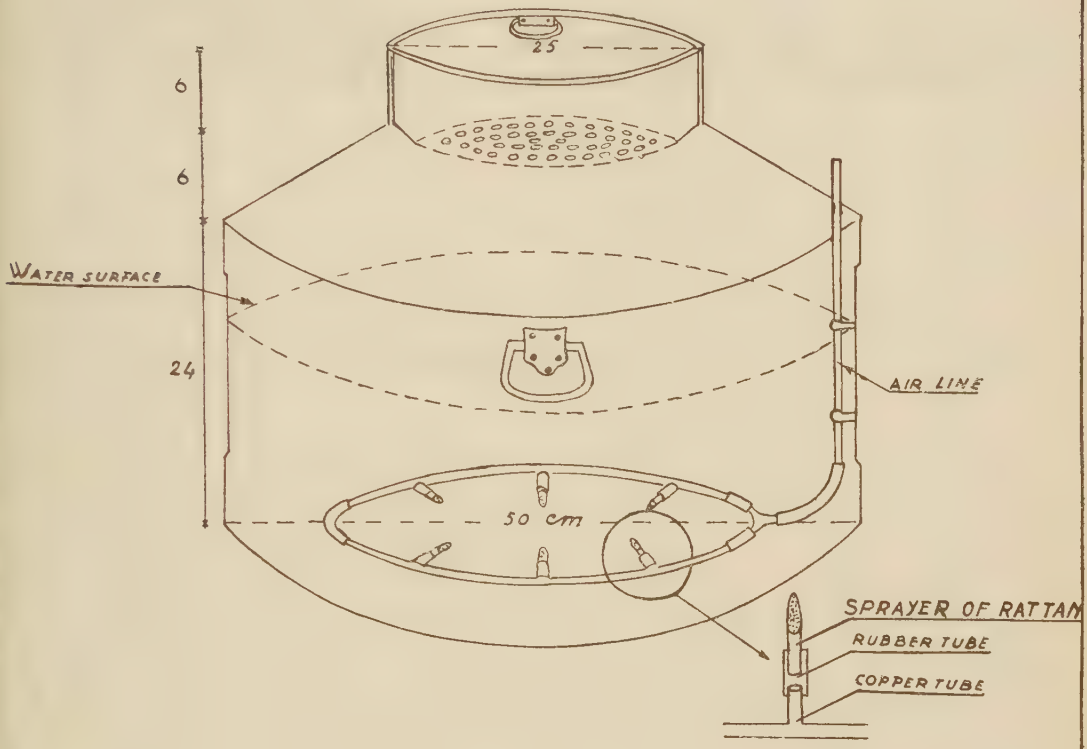
On one occasion (exp. I) high cont diameter 40 cm., height 55 cm., filled wit of water, were used. High containers pr be less suitable to the ordinary ones.

The rate of mortality in lot A and listed as follows:

With the aid of aerating techniq container with 20 l. of water carried as n 978—1086 fingerlings of 50—70 mm., of the rate of mortality was respectively 5.5- In full capacity (30 l. of water), the tin able to transport 705—832 larger fishes of mm. with the mortality rate of respectivel 11.2%.

FIG.1 FISH CONTAINER

SCALE: 1:5



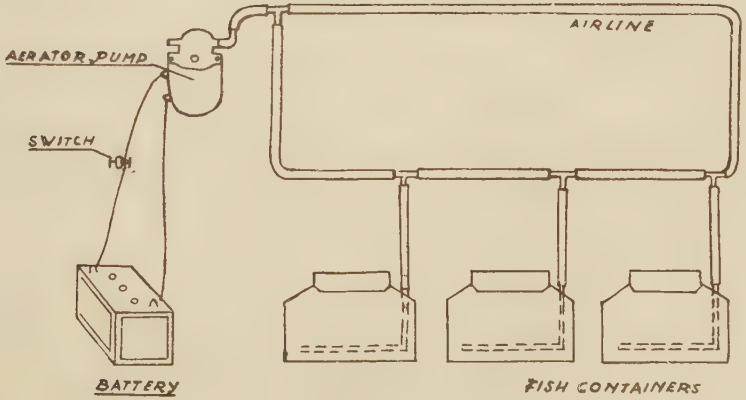


FIG. 2 SCALE: 1: 25

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Date and Experiment No.	Volume of Water in Tins Lt.	Time		Duration in hours	Distance kms.	Number of Fish	Total Weight kg.	Total length in mm.		Ratio	Mortality		Remarks
		Departure	Arrival					min.	max.		Number	%	
3 June 1958													
I. A.	57	07.30	11.30	4	125	763	3.0	70	110	1:19	21	2.75	Death occured in 4th hour (Lot A)
B.	57	07.30	11.30	4	125	741	3.0	65	110	1:19	36	4.8	Death occured in 1st hour (Lot B)
16 June 1958													
II. A.	30	07.37	13.00	$5\frac{1}{2}$	183	377	2.0	65	90	1:15	0	0	Fishes died in 1st —3rd hour
B.	30	07.37	13.00	$5\frac{1}{2}$	183	363	2.0	65	95	1:15	57	15.5	
19 June 1958													
III. A.	30	07.15	11.15	4	162	832	3.0	60	95	1:10	0	0	
B.	30	07.15	11.15	4	162	590	2.0	65	90	1:15	0	0	
14 July 1958													
IV. A.	30	07.30	11.45	$4\frac{1}{4}$	162	705	3.0	65	120	1:10	80	11.2	Aerator pump got defect in 2nd hour (Lot A)
B.	30	07.30	11.45	$4\frac{1}{4}$	162	486	2.1	70	145	1:14	0	0	
13 Oct. 1958													
V. A.	20	08.00	12.00	4	102	1086	2.0	50	70	1:10	6	5.6	Catch without flowing water.
B.	20	08.00	12.00	4	102	1661	2.0	50	70	1:10	1236	73.2	Aerator pump got defect in 3rd hour. Death occured in 4th hour (Lot A). In 1st hour car stopped 15 min. Death occured in 1st—3rd hour (Lot B)
15 Oct. 1958													
VI. A.	20	08.45	13.00	5	175	978	2.0	53	76	1:10	611	60.4	Catch without flowing water. Death occured in 3rd hour (Lot A)
B.	20	08.45	13.00	5	175	1129	2.0	53	75	1:10	163	14.5	Death occured in 1st hour (Lot B)
18 Oct. 1958													
VII. A.	20	08.45	13.45	5	186	625	1.5	55	76	1:15	6	0.9	
B.	20	08.45	13.45	5	186	424	1.5	55	76	1:15	79	15.5	

Note: A: aerated

B: non—aerated

Water in Tins during the Transportation of *Chanos* fingerlings

Experiment No.	Aerated (Lot A)							Non Aerated (Lot B)							
Date	Time	Temp. °C air	Temp. °C water	Salinity 0/00	Diss. Ox. mg/L	Free CO_2 mg/L	pH	Alkalinity HCL cc. 0.1 N.	Time	Temp. °C air	Temp. °C water	Salinity. 0/00	Diss. Ox. mg/L	Free CO_2 mg/L	pH	Alkalin HCl c O.1 N
I. 3 June 1958	06.45	28	28.5	10	1.2	0	7.1	1.0	(Samples from Storage Pond)							
	07.00	28.5	28.5	5	4.9	6.5	7.2	1.2	07.10	28.5	28.5	5	5.2	5.—	7.2	1.4
	08.30	28	28	5	1.2	6.—	7.1	1.4	09.30	28.5	27.5	5	1.54	7.—	7.0	1.3
	10.30	29	28	5	2.4	8.5	7.0	1.3	11.30	31.0	28.5	5	2.1	8.—	7.0	1.3
II. 16 June 1958	07.00	24.5	27	11	—	0	6.9	1.2		(do)						
	07.20	25	27	7	10.—	0.7	7.—	1.3	07.20	25.0	27	7	8.9	0.7	7	1.4
	08.30	27	27	7	2.9	2.3	7.—	1.7	08.30	27.0	25	7	2.—	1.2	7	1.3
	09.30	28	24	7	4.8	1.3	7.—	1.4	09.30	28.0	27	6	1.7	1.2	7	1.3
	10.30	31	24	6	4.4	—	—	—	10.30	27.0	27	6.5	1.9	—	—	—
	13.00	31	25	—	6.2	1.4	7.—	—	13.00	32.0	28.5	6	2.—	1.2	7.1	—
III. 19 June 1958	06.25	24	27	12	3.3	0.6	7.1	1.2		(do)						
	07.00	24	25	6	6.—	0.8	7.0	1.3	07.00	24.0	26	6	6.2	0.8	7.2	1.2
	08.15	25	23	6	6.2	—	—	1.4	08.15	26.0	23	6	3.1	0.8	7.2	1.3
	09.15	27	23	6	3.4	0.5	—	1.3	09.15	29.0	23	6	2.0	0.6	—	1.0
	10.15	29	24	6	5.2	0.6	—	1.1	10.15	30 0	24.5	6	2.1	0.6	—	1.2
	11.15	30	26	6	5.6	0.8	—	1.4	11.15	30.0	26	5	1.7	0.7	—	1.1
IV. 14 July 1958	06.30	24	26	10	3.8	0	—	1.2		(do)						
	07.00	25	27	6.5	8.6	0.4	—	1.3	06.55	25	27	6.5	6.2	0.5	—	1.3
	08.30	28	24.5	6.5	1.4	0.7	—	1.3	08.30	28	24.5	6.5	2.7	0.8	—	1.2
	09.30	30	23.5	6.5	5.9	1.2	—	1.3	09.30	30	23.5	6.5	2.2	1.4	—	1.4
	10.30	30	24.8	6	3.8	1.1	—	1.7	10.30	30	24.5	6.5	1.8	1.3	—	1.7
	11.45	31	25	6.0	3.9	1.4	—	1.1	11.45	31	25	6.5	1.5	1.4	—	1.0
V. 13 Oct 1958	07.35	26.0	26.5	6.0	4.4	0	7.4	1.8		(do)						
	09.15	26.0	26.0	5	0.6	—	7.3	—	09.15	26	26.5	6.0	1.1	—	7.2	1.4
	10.10	28	26.5	6	1.4	—	—	—	10.10	27	25	5	—	—	—	—
	11.10	28	26	6	1.4	—	—	—	11.10	28	25	6	1.4	—	—	—
VI. 15 Oct 1958	07.00	26.5	27.0	11	5.2	0	7.2	1.6		(do)						
	07.15	27.0	27.0	5	9.2	0	7.1	1.5	07.15	27	27	5	3.5	0	7.0	1.4
	08.05	29.0	25.0	5	0.7	—	—	—	08.05	29	25	5	1.0	—	—	—
	09.00	30.0	25.5	5	1.6	—	—	—	09.00	30	26	5	0.5	—	—	—
	10.05	31.5	26.0	5	5.7	—	—	—	10.05	31.5	26	5	2.1	—	—	—
	13.00	32.0	25.5	5	—	—	—	—	13.00	32	26	5	—	—	—	—
VII. 18 Oct 1958	07.00	26.5	27	16	4.8	—	7.0	—		(do)						
	07.20	27.0	27.5	16	5.7	—	7.2	—	07.10	27	27	16	7.6	—	7.0	—
	08.45	30.5	27	15	2.4	—	6.8	—	08.45	30.5	27	15	2.1	—	6.8	—
	09.15	—	—	11	2.7	—	—	—	09.15	—	—	14	2.2	—	—	—
	10.45	—	—	14	2.5	—	—	—	10.45	—	—	14	0.9	—	—	—
	11.45	—	—	13	1.4	—	—	—	11.45	—	—	13	1.6	—	—	—
	12.45	—	—	12	2.1	—	—	—	12.45	—	—	12	1.4	—	—	—
	13.45	31	26.5	—	1.4	—	6.7	—	12.45	—	—	12	—	—	—	—

SOME OBSERVATIONS ON *CHANOS* CULTURE IN FRESH WATER

by

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ABSTRACT

Though cultivation of *Chanos* in fresh water has been conducted since long in Indo-sia, remarkably none have developed into commercial or permanent private enterprises.

The only *Chanos* culture known as "paddy—cum—milk—fish" culture, was esta-shed in 1954 on the initiative of the people themselves. This type of cultivation of *anos* combined with *Puntius javanicus* in rice fields is very unique. It gives an additional ome of ca. 370 kg. fish per ha. per annum.

As a result of an experiment conducted in 1951, this fish is reared at the vernmental Fish Farm at Krapjak (Jogjakarta), which is known to be very fertile, due to irrigation from city sewage. Its yield varies annually from 4,300—5,100 kg. *Chanos* per ha.; s yield is never reached in brackish water ponds. The production of *Chanos* is similar that of common carp.

A new less fertile pond at the Depok Fresh Water Experimental Station, with the plication of some manure, has produced 550 kg. *Chanos* per ha. per year. This production somewhat higher than that of common carp. A graphical study of the growth rate shows at the rate is less than in brackish water ponds.

From preliminary studies on the gut contents of the fishes, it became obvious, that *anos* appeared to prefer *Cyanophyceae*, whereas *Puntius* taken from the same "ponds" prefered gher plants and *Chlorophyceae*. Zooplankton is found sporadically; it consists of crustacea, *tatoria*, *Protozoa* and worm eggs. Samples of the gut contents of fish taken from the Krapjak sh Farm, show a similar phenomenon, i.e. that *Chanos* feeds mostly on phytoplankton, among nich Diatom forms the most constituent. *Cyanophyceae* and *Chlorophyceae* occured on out equal proportions in the gut—contents of the fish, while the last mentioned was und in greater abundance in the water.

INTRODUCTION

Fresh water forms more or less a chain in fe—cycle of the *Chanos*, as it is a known hat they live in fresh water.

As any other catadromous fishes, *Chanos* ns in sea, from where the young larvae ite ashore and get into brackish water. ascend streams and if they have the e, they even enter fresh water lakes and n there until they reach sexual maturity. they return again to their habitat, the sea.

Recent records have been received on ccurence of large *Chanos* in lake Sagea, away from the sea, on the island Halm-. An older record originating from ster (1949—50), stated that in Lake Tempe th Sulawesi) 60 km. away from the sea, adult *Chanos* were often caught. Also in brackish water ponds in Java, *Chanos* was often found entering freely into the ponds.

Similar reports are received from the Philippines, and Lake Taal, Naujan and Bato are well known for this occurence. As is stated by Villadolid (1937) *Chanos* remain in lake for about 2 to 4 years and attain a length of 50 cm. They are caught together with other migratory fishes (*Caranx spp*, *Lutianus argentimaculatus*, *Harengula terlis*, *Megalops cyprinoides*d, etc.) on their way back to the sea.

Transplantation into fresh water in Indonesia as well as in other countries has been done since long. Encouraged by satisfactory results, stocking of inland waters with *Chanos* fingerlings is done on large scale in India, (Ganapathi, *et al*, 1950).

In Formosa this fish used to be reared combined with fresh water specimens (*Hypopthalmichthys molitri*, *Ctenopharyngodon idellus* and *Cirrhina molitonells*) (Chen, 1950).

In Indonesia transplantation of *Chanos* into fresh water, dates back to as early as 1927, as reported by Schuster (1949). In that year Reyntjes stocked a fresh water tank (Pridjitan, East Java) with *Chanos* fry to observe the development of the gonads.

Three years later more than 4 kg. fish was caught, of which the gonads were found undeveloped. Between 1930—1935 Schuster had also repeatedly stocked the tanks Djoto, Sentir and Djatimanis (Lamongan) with *Chanos* fry, where they were reared together with *Osteochilus hasselti*, *Puntius javanicus* and *Cyprinus carpio*. In 8 months the fishes were reported to have attained a weight of 0.5 — 0.7 kg. Also in other places such as lake Tjiburuy (Bandung) in 1,930. stocking took place, and stocking is still occasionally done even now, mostly for experimental purposes or curiosity, which remarkably, never developed into commercial enterprises. With respect to the results of *Chanos* cultivation in fresh water ponds, a report from India is available, in which it is stated that the rate of *Chanos* growth reach maximum in fresh water, and is less in bra water and even lesser in confined sea (Chidambaram, 1946).

Roxas and Umali (1937) said that C is unprofitable to culture in fresh water, the growth of algae is entirely inadequa supply their needs for rapid growth.

The authors of this paper have f that a fertile pond as represented by the Kr Fish Farm which receives its water from sewage (Schuster, 1949) is able to give duction of 8 — 10 times the production of 500 — 600 kg. of a fertile brackish water Also a less fertile pond with application of ure at Depok, may produce as much a kg./ha./year; this production can be obtained from brackish water ponds whi ranked first class.

Another interesting fact is the a equal production of *Chanos* and common ca

The authors of this paper are indebt Mr. H. Saanin, Head of the Laboratory fo land Fisheries, and Mr. M. Sachlan, who so kind to extend the necessary facilities help in the examination of microorga in the gut contents of *Chanos*.

Table 1. Results of *Chanos* culture in Fresh Water Fish Farm at Krapjak — Jogjakarta.

Exp. No.	Surface of the pond Square meters	Date of Stocking	Date of Harvesting	Number of fish stocked	Harvesting Number of fish	Stocking Total fish weight in kg.	Harvesting Total fish weight in kg.	Stocking period	Mortality %	Increase of weight in kg.	Yield per ha per annum kg.
I	500	2. I. 1951	22. V. 1951	800	399	x)	108	140	50		
II	500	16. VI. 1951	2. IX. 1951	2,500	1,671	x)	63	78	33.2		
	500	16. VI. 1951	2. IX. 1951	2,500	1,506	x)	62	78	39.8		
	500	16. VI. 1951	2. IX. 1951	2,500	2,010	x)	66	78	19.6		
	500	16. VI. 1951	2. IX. 1951	2,500	1,805	x)	69	78	28.—		
III	500	2. IX. 1951	5. XII. 1951	400	350	15	80	94	12.5	65	1,300
	500	2. IX. 1951	24. XII. 1951	400	391	16.5	92.5	113	32.—	76	1,520
	500	2. IX. 1951	9. I. 1952	400	343	14.5	74.5	129	14.—	60	1,200

x) fry

SURVEY ON CULTURAL PRACTICES OF *Chanos*

i. Chanos culture in the Krapjak Fresh water Pond (JOGJAKARTA)

The Krapjack fish pond system covers an area of 1.2 ha., with an altitude of 113 m.

These ponds are irrigated by sewage from the city, which has passed through a purification installation. The effluent from the filter and sedimentation tanks is further purified with two methods e.g. the mechnical and biological method. A part of the outflowing water is diluted with river water in the ratio of 1 to 3. This dilution process takes place in 1,200 m^2 pond, where various kinds of fishes (Carps, *Puntius* and Kissing Gouramy) are reared. A tabular statement in Vaas' publication (1948) indicated high fish production of 4,000 kg. per ha. per annum. For particulars of the purification system, Dr. Vaas' publication may be consulted.

Though the Krapjak Fish Farm is nearly 7 km. away from this place, the irrigation water still shows a high content of organic matter. Heavy deposits of this organic matter in the ponds, which might be harmful to the fishes, e.g. oxygen deficiency by heavy decay and toxic-process by anaerobic mineralization, are prevented by a four-compartment-sedimentation tank.

Until 1950 these ponds were mainly used for rearing *Cyprinus carpio*, *Osphronemus gouramy* and *Tilapia mossambica*. The last mentioned, which is known to have a great adaptability, propagates here prolifically. Carps, however, couldn't breed, owing to the high content of organic matter of the water.

In 1950 the Head of the Local Fisheries Service (Hoesein Taniatmadja) succeeded in performing a breeding method, by a specially devised filter system of the undissolved organic matter.

Chanos culture was started here in 1950. As in the case of brackish water fish ponds, the fry are first released into a small compartment, called "baby—box" (4 m^2), and remain there for 7 days. Afterwards the fishes are allowed to enter a larger compartment (500 m^2), by cutting down the partition dyke. They are kept there for 2-3 months, after which they will be distributed to the rearing ponds. In some cases the rearing of fry to consumption fish takes p the same compartment; this depends up rate of fish stocking.

The fry, transported in ordinary fr tainers (capacity 5,000-7,500 fry) by truc railway, are acclimatized for about 24 ho fore they are released into the fry pond way of preparation for stocking is simila practices in brackish water fish ponds. sists of draining, drying and leveling bottom, checking leakages on the dyk so on.

Due to the heavy deposits of matter, the fry ponds must be subjec intensive tilling of the soil and expos sunlight.

The water proper in the baby-b the fry pond is kept running continuously depth in the baby-box is kept at 25 cm. first few days the fishes are fed with fi flour.

The Krapjak fish farm is known fertile. Its fertility is due to the sewage rice fields in the surroundings of the which are also irrigated by the same sew able to produce 8 tons of paddy (2 crops).

Table I contains data obtained observations.

As seen in the table, a compart 500 m^2 produced 60 to 75 kg. It means 5,100 kg. per ha. per annum. The averag of a single crop of common carp and from the same ponds is respectively 5,(and 7,500 kg./ha./annum. The yield of is assumed to be similar to the yield The yields of *Chanos* during 6 years w follows:

1952	4,600 kg. per ha.
1953	3,630 kg. per ha.
1954	4,170 kg. per ha.
1955	5,980 kg. per ha.
1956	5,710 kg. per ha.

(Administrative Report of the Extension for Inland Fisheries, Jogjakarta).

The stocking period, from fry to fin was 7 days, during which they attained a of 9 to 15 cm. This is about the growth reared in brackish water ponds with stocking rate (Schuster, 1949).

The stocking rate in fry ponds was 5 $i.^2$ In comparison with the high rates rackish water nursery ponds (Djaja- ja, 1957), this can still be increased. On ther hand, in rearing ponds as many as 400 ocked in 500 m^2 ponds. It means 8,000 per a rate which is much higher than usually l in brackish water, i.e., 500 to 1,500 per ha. growth was considerably rapid. In 20 s the fishes attained a length of 30 to 36 cm. the average weight of 273 grams.

The rate of mortality in the fry pond may sumed as low. In 78 days the average loss 30.3 %. Djajadiredja (1957) recorded an ge loss of 39.6 % (60 days) from the Kamal ish water nursery ponds, which were inten- y prepared and managed.

Also the average loss of 19.7% in the ng ponds was considered to be normal. In ish water ponds it ranges from 10 to 20%.

In Jogjakarta, *Chanos* is also reared in eries at Dongkelan, Wonotjatur and Sempu. yields were considerably lower, due to lesser ity.

addy — cum — milk — fish culture

Since 1954 in East Java a new type of *os* industry has been developed.

Actually these rice fields must have been ary brackish water ponds (Indon: tambak), hich *Chanos* was cultured. With regard to locality, layout, measurements, irrigation m and its large banks, these "paddy - cum - - fish" ponds (Indon: sawah - tambak) l still be grouped in the "inland - ponds" uster, 1949). Accordingly, the various ches of the brackish water industry, which comprises the "combination - culture", as ribed by the same author (Schuster: 129), are in the last years enriched with new type of fish culture.

As time passes, natural process has ged the brackish environments into fresh r, due to the steady deposits of mud after rring floods and tides, which increase the ht of the ground, on which the irrigation nels, ditches and the ponds are situated. resulted in the change of the biotype, h made fish culture risky and unprofitable, at people gradually changed their custom of cultivation to rice planting. The present operation of fish - rearing combined with rice planting was also disappointing in most cases, and seems to be the end - point of the farmers' effort to make their land as profitable as possible. Djaingsastro (1957) stated that an extra income from 370 kg. of fish per ha. per year was obtained.

The total area of the "sawah - tambak" amounted in 1956 approximately to 1,059 ha., situated entirely in the Regencies of Surabaya and Lamongan (East Java). According to Djaingsastro, there are more than 60,000 ha. rice fields, which could be converted into such ponds.

The main cultivated fish is *Chanos chanos* and *Puntius javanicus*. Fry of the latter is caught in large quantities along the Solo river and its tributaries, whereas *Chanos* fry comes mainly from the island of Madura (East of Java).

The ponds are provided with a wide (3 to 5 m.) ditch along the dykes, which forms the deepest part of the pond. Irrigation of these ponds is done in the same way as in the brackish water ponds, the water is tapped from the canal and enters the ponds via a wooden gate. It is typical of these paddy fields, that in most cases, except in the rainy seasons, when water is plentiful, water from the canal must be scooped by human labor.

One may start stocking early in the rainy season, usually one month before rice planting. In the first instance, the paddy - field should be separated from the ditch by making low temporary dykes. The fry is introduced in the ditch. At this time, the water is kept at 10 cm. in the middle part, where rice has to be planted, and 70 cm. in the ditch. The fry can not be harmed, while preparatory work for rice planting, is done as they are located in the ditch. After rice planting, the temporary dyke is broken down, so that the fry are able to disperse into the middle part of the paddy field. The depth is then increased to about 20 cm.

Fry of *Chanos* and *Puntius* may be stocked either at the same time or each separately. Fish stocking is done twice a year. The stocking rate is high, e.g. 8,250 of *Chanos* fry and 16,500 *Puntius* per ha. In April - May the ponds are stocked again with *Chanos* and *Puntius* - fingerlings respectively as many as 5,500 and 2,250 per ha. The first crop is usually got after 4 to 6 months. Large fishes already suitable for consumption are selected and the smaller ones

are released again. The entire catch is taken about 10 months after the first fish stocking. Due to the continuous irrigation of the fields two rice crops can be obtained per year. Usually the first rice harvest does not go together with the catch of the fish.

During the authors' observation at Lamongan, it became known that the rate of mortality is high (90 to 95%). High stocking rate is probably meant to compensate the heavy losses.

Up to the present there is no reliable data on the production of this paddy - cum - milk - fish ponds.

iii Cultivation of *Chanos* at Depok (Djakarta).

Experiments on *Chanos* cultivation at the Depok Experimental ponds was made early in 1958. This pond system has just been completed in 1956; these ponds belong to the poorly rated group.

For this purpose a 1,000 m^2 pon used. Two other ponds were stocke common carp, used for comparative m All the three compartments were fertilize stable manure.

The method of preparation, mana etc. were similar to those at Krapjak. T was kept for 7 days in the "baby - box", after they were transfered to the fry pond After 8 weeks the fingerlings were counted and measured. It should be note that on the 4th week the pond was floo that most of the fry was lost. Out of 10, only 1,200 fingerlings were found, of 1,000 fingerlings were put again into th compartment. Here they were reared u weeks.

Every 4 weeks, samples has been As 290 fishes were damaged during this these fishes were included in the morta in Table 2.

Table 2

Chanos And Carp Production in Fresh Water Experimental Ponds at Depok

Lot. No.	Acreage m^2	Fish species	Period in days	Stocking			Harvest			Increase of weight	Mortality %
				Number	Size of fish in cm.	Total weight in kg.	Number	Size of fish in cm.	Total weight in kg.		
D_1	1,000	*Chanos chanos*	119	1,000	4—9	1.8	342	16—23	20.0	18.2	65.8
D_2	1,000	*Cyprinus carpio*	46	1,000	4—7	3.5	710	10—13	10.0	6.5	29.0
D_3	1,000	*Cyprinus carpio*	46	1,000	4—7	3.5	800	7—11	9.0	5.5	20.0

From this table it is evident that the yield of Chanos per unit of area is somewhat higher than that of common carp.

The high mortality of *Chanos* is caused by the death of 250 fish owing to an accident in the 3*rd* week.

The production is low in comparison with that obtained from the ponds at Krapjak. The reason must be sought in the difference of the fertility of both ponds. Experience gath Depok as well as at Krapjak, however, similar picture with respect to the produc *Chanos* and Carp.

The production of these 2 specie about equal. Compared to the produc brackish water ponds the yield of 550 kg. per annum may still be regarded as high.

The rate of growth is shown in Fig. 1. It dent that the fish indicate a slow growth. the fishes reared in the fertile pond at ak show a normal growth in a brackish pond, those from a less fertile pond at appeared to grow rather slowly.

During 8 weeks in the fry pond, they attained an average length of 56.75 mm., and after 24 weeks 195.50 mm. As shown in Figure 1, the fishes were thin.

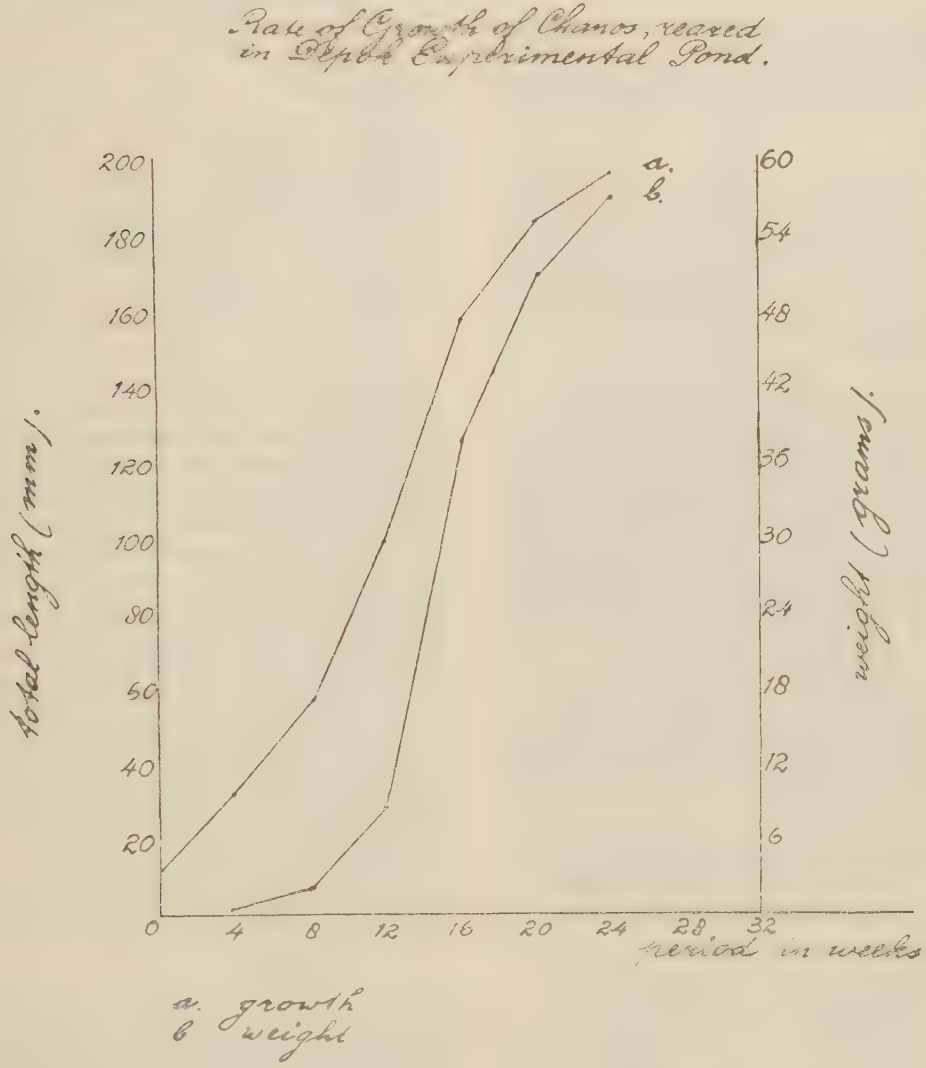

Fig. 1. Some Notes on the Food Feeding Habits of *Chanos* Reared in Fresh water Ponds

In contrast with the fact, that *Chanos* is nly fish cultivated in brackish water, people cquainted with more species in fresh water s. Consequently in relation with *Chanos* duction in fresh water, study of food and ng habits of this fish is of primary import-

This branch of study is being dealt with by many research workers throughout the Indo-Pacific Region as annotated by Schuster (1952). Except Job and Chacko (1947), who studied the fry in fresh water, most of them have made a study of the *Chanos* from brackish water and some from the sea.

This paper contains preliminary results of the study of the gut contents of a few *Chanos* collected from paddy fields at Plosobuden and fresh water ponds at Krapjak. For this purpose only the oesophagus contents of the fishes were taken. The same was done with *Puntius* from Plosobuden.

To determine the feeding habits of *Chanos*, plankton sampled from these ponds were studied, with a view to examine the correlation between food supply and the kind of food taken by the fish.

In the dry season of 1957, three compartments of different fertilities were studied. All the compartments were stocked with the above-mentioned fish and were grown with 1 month old paddy. The first compartment was known to be poor and the other two were fertile due to their irrigation from village wastes.

Net-samples from compartment I contained mainly zoo-plankton (95.54%), of which Crustaceae formed the main constituent, followed by Rotatoria and Protozoa. Samples taken from the other two fields, however, contained considerable percentage of phyto-plankton, respectively, 97.51 % and 80.76 %. Out of the phytoplankton in all the three compartments, Cyanophyceae formed the main component followed by Diatomeae, Chlorophyceae, and Euglenineae which occured fewer amounts.

Observations conducted during the dry and rainy season of 1957 at the Krapjak ponds, gave the following results.

Table III Plankton-samples, taken from *Chanos* fresh water ponds at Krapjak; ratio in number per l.

Phytoplankton :	
Diatoms	75.89 %
Chlorophyceae	9.88 %
Cyanophyceae	4.16 %
Euglenineae	2.36 %
Zooplankton :	
Crustaceae	3.61 %
Rotatoria	2.46 %
Protozoa	1.64 %
Vermes	—

From the list it is obvious that Diatoms formed a vital component. This corresponds with the finding of Vaas (1948). He also fou next to diatoms came Chlorophyceae, fo by the Cyanophyceae and Euglenineae. the zoo-microorganisms, Crustaceae are th important.

As mentioned before, out of the i tract of the fishes, the anterior part oesophagus was taken, the contents of were examined. From the study at the " cum-milk-fish" pond at Plosobuden i evident, that in compartment I, in which plankton constituted only 4.45% of th microorganisms as well as in compartm where the plankton consisted mostly of plankton (97.51%), *Chanos* of 21.0—29.5 total length, prefered phytoplankton zooplankton. The gut-contents consisted of soft and digestible blue-green (Cyanophyceae), and is followed in quantity by Diatoms. In 50% of the sa Chlorophyceae (both *Conjugales* and *coccales*) were not found. In some sa Euglenineae occured in larger quantitie Chlorophyceae. Zooplankton, which rarely in several samples, consists of Crus Rotatoria and Protozoa. The eggs of mud particles, the substances of high wate and detritus were also found in the oeso cavity. The plant-detritus in some sampl found in enormous proportions.

Puntius javanicus of 9—12 cm. in collected from the same compartments which samples were taken, proved to higher plants and Chlorophyceae. Blue algae and diatoms existed in almost every but only a few species were found. Zoopla which was mostly represented by Crus occured, especially in compartment I, mo in *Chanos*.

At Krapjak 2 ponds were studied. these two ponds, in the rainy season, 31 of 18.2—34.9 cm. in length, weighing 60 grams, and four months later (in the dry s another 15, measuring and weighing respe 22.2—28.0 cm. and 95—155 grams, were co and the oesophagus contents examined. fishes, as *Cyprinus carpio* and *Tilapia moss* however, which were also found in the were not studied.

For comparative material we refer observation of Vaas (1957), who studi influence of the environment on the diet

n carps (also *Tilapia mossambica* and *ma temmincki*) in the sewage pond at gloa (Bandung).

From semi-qualitative study, in Krapjak, evident, that *Chanos* feeds mainly on lankton. Zooplankton was present in almost all the samples; in 7 fishes it was totally absent.

The following list shows the number of fish and the proportion of food present in their guts.

	Plenty	*Fair*	*Rare*	*Present*	*Absent*
ation I					
Blue-green algae	—	2	10	13	3
Diatoms	—	8	12	8	—
Green-algae	—	3	10	15	—
Zooplankton	—	—	—	27	1
Detritus	16	12	—	—	—
ation II					
Blue-green algae	1	2	2	10	5
Diatoms	—	4	12	3	1
Green-algae	—	1	3	14	2
Zooplankton	—	—	3	11	6
Detritus	4	3	—	—	13

Coinciding with the fact, that the net s indicated an abundant occurrence of ns, the contents of the guts comprised of this sort of algae; blue-greens were t in about the same quantity with green- though the last mentioned occured more net-samples.

Among the Diatoms were identified, e.g. *ula*, *Nitzshia*, *Pinnularia*, *Cocconeis*, *lla*, *Gomphonema*, *Surirella*, *Stauroneis*, *ra*, *Cyclotella*, *Melosira*, *Diatoma* and *ntadium*. The *Cyanophyceae* were repre- by *Oscillatoria*, *Phormidium*, *Nostoc*, *na*, *Merismopedia* and *Microcystus* and *phyceae*. *Euglena*, *Phacus* and *Peridinium* also part of the gut-contents. The nkton comprised of *Brachionus*, *Filinia*, *nosoma* and others, belonging to *Entromo-* *Phylopoda (Crustaceae)*, *Arcella* and *gia*.

usions

The production of *Chanos* in fresh water proved to be much higher than the ction in brackish water ponds. *Chanos* a great capability of normal growth in water and is able to provide production an equal to common carp.

As *Chanos* is a selective plankton feeder, ns and blue-green-algae being preferred, it safely cultured combined with fresh water ke *Cyprinus carpio*, *Osphronemus gouramy* *untius javanicus*.

In some localities, where there is abundant occurrence of *Chanos* fry, and where brackish water ponds are rare or not available, it will be advantageous to use the fry for stocking of fresh water. In Java, however, it is difficult to recommend the use of *Chanos* fry on large scale for stocking of fresh water, as fry of several fresh water specimens are easily obtained.

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THE USE OF ENDRIN AS A PISCICIDE IN MINING POOLS AND FISH PONDS IN MALAYA

by

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ABSTRACT

There is an urgent need among fish culturists in many areas of the Indo-Pacific ion for a cheap and efficient piscicide, especially in dealing with large bodies of water such lisused mining pools which are often many acres in extent and 10 to 30 feet deep. Endrin d in the form of an emulsifiable concentrate has been found to be most useful in Malaya. e recommended dosage is 0.008 p.p.m. in terms of endrin. Used at this concentration, it is nd to be much cheaper than the two well-known and widely used piscicides namely, -seed cake and derris root. Moreover, fish poisoned at this concentration of endrin has n found to be fit for human consumption.

INTRODUCTION

One of the major difficulties confronting ming in Malaya and indeed in most coun- n South-east Asia is the need to rid ble waters off predatory fishes, before cking them with desirable species.

In Malaya fish farming is carried out in w-lands under varying conditions. fish are cultivated in ponds, these may wo types, namely those which are so con- d as to enable them to be easily drained vesting and elimination of predators and which because of the terrain are not drainable. Since Malaya is also a rich ning country, mining operations have in areas left behind numerous large pools are filled with water in time. These erve as excellent sites for fish farming, gh is would be impossible to drain them t incurring very heavy expense. It is in to these waters which are not subject to rainage that the need for a cheap and t piscicide arises, particularly against ry fishes such as *Ophiocephalus striatus* *larias batrachus* which inevitably gain ce to these waters during occasional or even overland from nearby streams lly after heavy rains.

2. Piscicides in use

A reference to published literature on fish indicates that the two most important les in use are tea-seed cake *(Camellia)* which contains the active principle saponin and *Derris elliptica*, from which the equally active principle rotenone is obtained. In Malaya, both are used, the tea-seed cake being imported from China, whilst derris is grown locally. However opinion seemed to have been much divided as to the concentration at which these two piscicides should be applied. Birtwistle (1931:382) states in respect of tea-seed cake, "the amount required depends on the size of the pond to be treated and taking the unit 100 feet x 50 feet x 3½ feet (deep), 200 lb. is sufficient to produce a strong tea extract. Within 24 hours all the fish within the pond are killed." This rate of application is quivalent to 1,700 lb. per acre of water 3½ feet deep. *Hora* (1956:124) states that in China "the quantity applied varies from 50 to 200 kg. per hectare depending on the quantity of water left in the pond after draining." In the case of derris, *Hora* (1956:124) states that in China "one kilo of raw derris root may be required for the treatment of one hectare of pond surface." Whilst he did not specify the depth of the pond, the general impression from the text, was that the pond water was to be maintained at 15 cm. before applying derris. Similarly it was mentioned by *De Zylva* (1952:5) that in Malaya 5 lb. of raw derris root was used effectively on a pond 100 feet x 50 feet in size. Mention was however not made as to the depth of water in the pond, and since Malayan ponds are seldom more than 3 feet deep, this may be assumed as the depth of water in the pond referred to. At this rate, a 3 feet deep pond will require 8.7 lb. raw derris root per acre. In India,

Hora (1956:128) states that derris powder applied at the rate of 4 to 6 p.p.m. kills all Indian predatory fishes. This is equivalent to 33 lb. to 48 lb. of derris powder per acre of water of 3 feet deep.

The above discrepancies would appear startling but for the fact that the tea-seed cake and the derris root used were not standardized as to percentage of active principles. Indeed, it is known that commercial derris root has a very variable rotenone content. These considerations however do not help the fish culturist to overcome his underlying difficulty of assessing how much tea-seed or derris root should be used for a particular body of water. Thus the need for a piscicide which is cheap, effective and at the same time capable of being easily assessed in quantitative terms in relation to the volume of water to be poisoned is evident.

3. Endrin as a piscicide

Wyatt (1957:41) in his investigations on padi stem-borers has shown in experiments with young *Ophiocephalus striatus* that an emulsified solution of the well-known insecticide, endrin, is a most powerful piscicide. Following on these findings, we carried out a series of laboratory experiments to determine the relative toxicities of various toxicants in terms of concentration and cost. The toxicants experimented with were:-

(a) Endrin in the form "Shell" Endrex which is an emulsifiable concentrate containing two pounds endrin per imperial gallon.

(b) Dieldrin is the form of Dieldrex which is an emulsifiable cond containing two pounds dieldrin per i gallon.

(c) Aldrin in the form of "Shell" which is an emulsifiable concentrate con two pounds aldrin per imperial gallon.

(d) Derris root in the form of

(i) fresh extract

(ii) powder

(e) Tea seed cake extract.

Endrin in the form of "Shell" End added to a glass tank containing 35,000 laboratory tap water to effect a concentr 0.6 p.p.m. of endrin. The water was stirr a piece of stick to ensure complete mixin piscicide with the water. The pH of th was 7.6. A test fish *Ophiocephalus stria* placed in the tank and the live-perio This was repeated four times. The sa cedure was carried out for dieldrin and The results are given in Table 1.

From Table 1 it can be seen th given concentration, endrin is more *Ophiocephalus striatus* than dieldrin o and that probably dieldrin is more tox aldrin. No attempt was made to st relative toxicity of derris root extract seed cake extract because in each case th ingredient is variable from sample to sam

Table 1. Live-Periods of *Ophiocephalus striatus* placed in 0.6 p.p.m. of endrin, dieldrin and al

Piscicide at Conc. 0.6 p.p.m.	Length of Fish (cm.)	Weight of Fish (g.)	Live-period
Endrin	29	221	1 hr.
	29	216	1 hr. 5 min.
	29.5	237	1 hr. 15 min.
	29	215	1 hr. 33 min.
Dieldrin	29	216	5 hr. 55 min.
	28.5	197	5 hr. 30 min.
	29	212	6 hr. 25 min.
	30	255	more than 7 hrs. (died during night

e 1. *(Contd)*

Piscicide at onc. 0.6 p.p.m.	Length of Fish (cm.)	Weight of Fish (g.)	Live-period
drin	29	216	5 hr. 5 min.
	27.5	187	more than 7 hrs. (died during night)
	28	192	more than 7 hrs. (died during night)
	29.5	250	more than 7 hrs. (died during night)

4. Relative Toxicity of Piscicides for a Given Cost

From preliminary laboratory experiments, found that 0.04 p.p.m. endrin would kill *phiocephalus striatus* test fish within 6 hours. market cost of 1 Imperial Gallon of Endrex ining 2 lb. of endrin is $36.00. Calculated is basis, the cost of 0.007 cc. of Endrex is required to effect 0.04 p.p.m. Endrin 000 ml. of water is 0.0055c. On this given of .0055c a comparison was made of the ve toxicity of the following piscicides, ly, endrin as "Shell" Endrex, dieldrin as l" Dieldrex, aldrin as "Shell" Aldrex, fresh s Root extract, powdered Derris Root and Seed Cake extract.

0.0055c worth of "Shell" Endrex having n as the active ingredient, was added to a tank containing 35,000 ml. of laboratory tap water. The water was stirred to ensure complete mixing of the piscicide with the water. The pH of the water was 7.6. An *Ophiocephalus striatus* test fish was placed in the tank and its live-period noted. This was repeated four times. The same procedure was carried out for the other piscicides listed above. The results are given in Table 2.

From Table 2, it can be seen that for a given cost of 0.0055c endrin is relatively more toxic than the rest of the piscicides studied. Fresh derris root extract is relatively less toxic than endrin but more toxic than the others. Therefore it was concluded that for a given cost endrin in the form of "Shell" Endrex was relatively more toxic than the other piscicides studied.

e 2. Relative Toxicity of Piscicides against *Ophiocephalus striatus* for a given Cost of 0.0055c which is the calculated Cost of that Amount of Endrex capable of effecting 0.04 p.p.m. Endrin in 35,000 ml. of Water.

iscicide	Market Price	Conc. effected in 35,000 ml. of Water for a Cost of 0.0055c	Length of Fish (cm.)	Weight of Fish (gm.)	Live period
drin	As Shell Endrex at $36/- per Imp. Gal.	.04 ppm.	30.5	248	2 hr. 8 min.
			29	213	2 hr. 50 min.
			31.5	253	4 hr. 40 min.
			27.5	216	5 hr. 30 min.
ldrin	As Shell Dieldrex at $20/- per Imp. Gal.	.058 ppm.	27.5	207	more than 7 hrs. died during night
			29.5	239	— do —
			33	283	— do —
			30	258	more than 24 hrs. died during working hrs. of following day

Table 2. *(contd.)*

Piscicide	Market Price	Conc. effected in 35,000 ml. of Water for a Cost of 0.0055c	Length of Fish (cm)	Weight of Fish (gm)	Live period
Aldrin	As Shell Aldrex at $13/- per Imp. Gal.	.111 ppm.	26	175	more than 7 hr died during nig
			29	202	— do —
			30.5	255	— do —
			30	258	more than 36 hr died during second night
Fresh Derris Root Extract	90c per lb.	Undeterminable	28.5	211	4 hr. 5 mi
			29.5	224	6 hr. 30 mi
			30.5	253	6 hr. 42 mi
			28	215	more than 7 hr died during nig
Powdered Derris Root		Undeterminable	29	244	more than 7 hr died during nig
			30	267	— do —
			30.5	275	— do —
			31.5	295	more than 36 h died during second night
Tea Seed Cake Extract	30c per lb.	Undeterminable	27	208	more than 7 hr died during nig
			30	245	— do —
			30	285	— do —
			29	205	— do —

Table 3. Table for the Application of Shell Endrex to Enclosed Waters

Conc.	Water	Volume	Shell	Endrex
p.p.m. Endrin	in cu. ft.	in litres	as g. Endrin	as ml. Endre
0.001	1,000	28,320	.028	.14
0.002	1,000	28,320	.057	.28
0.003	1,000	28,320	.085	.42
0.004	1,000	28,320	.11	.57
0.005	1,000	28,320	.14	.71
0.006	1,000	28,320	.17	.85
0.007	1,000	28,320	.20	.99
0.008	1,000	28,320	.23	1.13
0.009	1,000	28,320	.25	1.27
0.01	1,000	28,320	.28	1.42
0.02	1,000	28,320	.57	2.83
0.03	1,000	28,320	.85	4.25
0.04	1,000	28,320	1.13	5.66
0.05	1,000	28,320	1.42	7.08

5. Field Trials

Trials were then carried out in the field "Shell" Endrex at different concentrations ds and mining pools. These concentrations worked out with the help of Table 3. The chemical was first diluted with water to form a milky white emulsion, after which it was sprayed on the surface of the pool with a hand sprayer. Results for these trials are shown in Table 4.

e 4. Field Trials with Different Concentration of Endrin showing Times taken for the Piscicide to be Effective.

ond No.	Area in Acres	Average Depth	pH	Endrin Concentration ppm.	Time taken for Piscicide to take Effect
P5	0.7	6'	7.2	.003	Bulk of Fish came up after more than 12 hrs.
P6	0.2	3.5'	6.2	.003	First Kills after 8 hrs.; Bulk after 10 hrs.
P8	0.03	3.5'	6.8	.003	First Kills after 10 hrs.; Bulk after 12 hrs.
P4	1.1	5.0'	—	.006	First Kills after 5 hrs.; Bulk after 10 hrs.
P7	0.02	4.0'	—	.006	First Kills after 3½ hrs.; Bulk after 10 hrs.
P3	4.8	20'	7.4	.006	First Kills after 5½ hrs.; Bulk after 12 hrs.
P10	1.2	15'	—	.008	First Kills after 4 hrs.; Bulk after 8 hrs.
P11	.07	10'	6.2	.008	First Kills after 4½ hrs.; Bulk after 9 hrs.
P12	0.7	3.5'	7.2	.008	First Kills after 1 hr.; Bulk after 6 hrs.
P9	0.7	4'	—	.01	First Kills after 2 hrs.; Bulk after 3 hrs.
P1	.14	4.05'	6.8	.01	First Kills after 20 min.; Bulk after 4½ hrs.

It will be seen that with a concentration of p.p.m. of endrin, it would generally be ble to poison a piece of water in the early ng and to complete the harvesting and l of fish catches by the afternoon. Accor- y this concentration was adopted as suitable e program for poisoning of ponds and g pools. The table also shows that the required for the piscicide to be fully ive, depends on the depth of the pool. The r the pool, the longer will be the time This is to be expected as the chemical eed time to diffuse to the lower layers.

6. Results of Field Applications

The use of "Shell" Endrex (at concentration of 0.008 p.p.m. of endrin) as a piscicide has been very successful in Malaya. To date some 108 acres of ponds and mining pools of different sizes and depth have been treated and re-stocked with *Tilapia mossambica* and *Puntius javanicus*. After ascertaining the required volume of "Shell" Endrex to be used, water was added to the chemical and the diluted emulsion was then sprayed with hand sprayers, working from the bank or from a small aluminium rowing boat, in the case of the bigger mining pools. The use of a boat with an outboard engine was

most effective and in this case, a siphon arrangement was used to drain the Endrex emulsion into the propeller flow of the engine, to take advantage of the churning effect.

Fish in distress, usually come up to the surface and swim about aimlessly. At this stage they can be easily scooped up with a net and removed for human consumption. It was noted that generally fish on the surface began to die some 20 minutes after application of the piscicide, and that the bulk of the fish would be affected at the end of four to twelve hours depending on the depth of the pool.

Dilute emulsions of Endrex in water lose their toxicity after a time, but is said to be very stable in neutral or alkaline waters. In our experience with mining pools which have a pH range of 6.0 to 7.4, the pools were found to be fit for re-stocking again after two to five weeks.

7. Fish Fauna of Mining Pools in Malaya

Incidentally the program of removal of predatory fishes from mining pools, also gave us an insight into the fish fauna of mining pools in Malaya. Apart from the common predators *Ophiocephalus striatus* and *Clarias batrachus* which were found in every pool in Malaya, the following rough fish were usually encountered.

1. **Cyclocheilichthys opogon** (C.V.)
2. **Osteocheilus hasselti**
3. **Hampala macrolepidota** (Van Hasselt)
4. **Puntius binotatus** (C.V.)
5. **Rasbora** sp.
6. **Trichogaster trichopterus** (Pallas)
7. **Oxygaster** sp.
8. **Notopterus notopterus** (Pallas)
9. **Puntius hexazona**
10. **Puntius partipentazona** (Fowler)
11. **Oxygaster oxygastroides** (Bleeker)
12. **Trichogaster pectoralis** (Regan)
13. **Macrobrachium carcinus** (freshwater prawn)
14. **Rasbora trilineata** (Steindachner)
15. **Cryptopterus** sp. (Lais)
16. **Anabas testudineus** (Bloch)

Of these, the most common were *Cyclocheilichthys opogon* and *Osteochilus hasselti.*

8. Problem posed in the Use of Endrin as Piscicide

The use of "Shell" Endrex emul concentrate in concentration of 0.008 p.p endrin to kill fish in abandoned mining poses one very grave question. Is en this concentration toxic to domestic a and especially to human being? It is that at high concentration "Shell" En definitely toxic to human being.

From information given by the Dep of Agriculture, Federation of Malaya, re D.A. 664 II/50 dated 24—10—57,* the or 50** for rats is 10—12 mg/kg. body Taking the figure 12 mg/kg. and assumi the average man weighs 150 lb. and t oral L.D. 50 for man is the same as for oral L.D. 50 for man is 816 mg.

Now if it is assumed that 0.008 endrin retains its initial toxicity for 3 and that this average man consumes (2,273 ml.) of water per day, then the m have consumed 120 pints (68,190 ml.) in 3 Let us assume that the toxic effect of en man is cumulative. In the treated por taining 0.008 p.p.m. of endrin, 1,000,000 water contains .008 g. endrin. Therefore ml. of water contains 0.0006 g. endrin a will be the amount of endrin taken b average man in thirty days. It will be that this is far below the oral L.D. 50 f which is 816 mg. This finding is substa by the fact that in many cases the fish ha from mining pools were eaten by the labourers nearby and there has not single complaint of illness from them.

Comparison of Costs of Raw Derris Root Endrin in Field Trials

In the case of raw derris root (1956:124) has noted that 1 kilo per hec water 15 cm. deep was sufficient. On th an acre-foot of water will require 0.9 kg. derris root which, at the present market p 90c (Malayan) per lb. will cost 1.80 M Dollars.

However an experiment carried one of us (Soong) in the field has shown

* L.D. 50-Median lethal dose i.e. 50% kill of test-animals

** also vide H. Martin (1953: 146-147) Guide to the Chemicals used in Crop protection (Can Dept. of Agriculture).

is eight times this amount of raw derris was required to effectively remove fish ors from one acre-foot of water in the On this basis an acre-foot of water will e $ 14.40c (Malayan) worth of derris root icide.

With "Shell" Endrex emulsifiable con-te, used at the concentration of 0.008 endrin, each acre-foot of water requires 9 ml. "Shell" Endrex. At the current price of $ 36 (Malayan) per gallon, this nly 40c (Malayan).

usion

It has been shown that endrin at 0.008 and used in the form of an emulsifiable ntrate known as "Shell" Endrex is a most nt piscicide. Moreover it is much cheaper than any of the accepted piscicides such seed cake or derris root. It is particularly in dealing with large bodies of water costs of the piscicides used, can be an ant consideration. The fish harvested with the use of endrin as a piscicide has not been found to be toxic to human.

Acknowledgement

Our thanks are due to Mr. Khoo Tiang Lim, Research Officer of the Fisheries Department, Federation of Malaya, from 3rd September 1957 to 31st December 1957 for carrying out many of the field trials. He was also responsible for drawing up table III showing the equivalents for application of "Shell" Endrex to enclosed waters.

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SOME ASPECTS OF COCKLE (*Anadara granosa L.*) CULTURE IN MALAYA

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ABSTRACT

The cockle fishery has assumed an important role in the economy of the fisherfolk o Federation of Malaya since culture was introduced in 1948. Some relevant biological asp such as habitat, breeding and growth are touched on. The fishery from the time of ga ring of spat to the collection of cockles for market is described in some detail. An esti of yearly production and the economics of the industry are outlined. The food value o Malayan cockle is compared with that of other shellfish and beef and indicates that Malayan cockle is a cheap source of protein food to the Malayan people.

INTRODUCTION

The genus *Anadara* has a worldwide distribution. Its culture has an ancient history in many lands. In China, *Anadara* was cultured before the 17th century. In Japan the culture of *A. granosa bisenensis* was reported to have been successfully started in 1859 and soon assumed considerable importance (Cahn, 1951). The genus is of some considerable economic importance in the Philippines, Thailand, Malaya and Borneo.

In Malaya the culture of *A. granosa* L. has but a recent history. It was about 1948, that the headman, Lee Ah Tee of Bagan Panchor, a fishing village off Kuala Jarum Mas on the Perak coast first experimented with the sowing of seed cockles obtained from the natural bed at Kuala Jarum Mas on to a patch of muddy foreshore in front of his village. The experiment was a great success as the young cockles registered phenomenal growth rates in the newly laid out areas compared with those in the natural bed. Since that time the culture of cockles spread rapidly throughout the mangrove areas of the West Coast, with the encouragement and advice of the Department, and has assumed considerable importance in the economy of many fishing villages.

The culture of the cockle has bee possible by the fact that there is a breeding season during which heavy occurs in certain definite areas. Colle young cockle for culture purposes is, th made easy.

Another important consideration the process of culture requires but a m of care and attention and hence labor, fo it yields very handsome dividends. mollusk is cheap to culture, it is sold a within the means of those with th modest of incomes.

DISTRIBUTION

Anadara granosa L. is one of several of this genus found in Malayan shores the only one popular among the local

Natural Distribution. Its natural distr is confined to the West Coast, but the beds are known to shift from year t Former well known beds, for exampl off the Kuala Kurau estuary in have now almost gone out of produc some years, whilst other new natura have appeared elsewhere. The main beds on the West Coast are:

(i)	Penang	—	Balik Pulau mud-flats	— 2,000 acres
(ii)	Perak North	—	Kuala Kelompang	— 200 acres
			Kuala Selensing	— 500 acres
			Kuala Jarum Mas	— 180 acres
			Kuala Larut	— 500 acres
			Kuala Trong	— 650 acres
			Tanjong Piandang	— 30 acres
			Kuala Kurau	— 50 acres

(iii) Perak South — Sungei Tanjong Burong, Bagan Sungei Belukang, Bagan Sungei Parit Bajang } Acreage undetermined

(iv) Selangor North - Beting Kepah (acreage undetermined).

e Beds. Some 3,500 acres of foreshore ing from the eastern shores of Penang in the North to Johore in the South ow under Government lease to cul- The greatest development is in Perak some 3,000 acres of foreshore are under . This estimation of acreage is minimal culturers are known to occupy many times licensed areas and it is often almost ible to make anything like an accurate of the occupied areas. The industry is panding.

On the East Coast another unidentified s of *Anadara* known locally as 'Krang occurs in some numbers and is utilised .

HABITAT

ra granosa L. occurs naturally in ge estuarine mudflats bordered landward ngrove. The water salinity is normally 30 °/00. In Penang Island the salinity from 31 °/00 to about 26 °/00 in the N.E. onal season because of monsoonal rains; ily range during the dry spell is about In Perak where the mangrove is very ive the daily range during the dry period year is 4 °/00,i.e., 24.2-28.2 °/00. The y is greatly affected by heavy rainfall considerable fluctuations of up to 14 °/00 nity do occur. However, unless there is uous rainfall the salinity rarely remains w level for any length of time.

a granosa L. thrives under com- ely calm conditions especially in shallow or bays, with a substratum of fine, soft, ent mud 18"-30" or more in depth. ent of water, i.e., a good tidal flow is al. Being mud-flats, the movement of ter keeps the water over the beds con- turbid. These areas are also shown by cords to be extremely rich in phytop- n.

Culture beds are in the main similar in to natural beds and especial attention is the nature of the substratum in selecting or culture purposes.

BREEDING SEASON

The anatomy and method of feeding of *Anadara granosa* L. has been described (Purchon, 1957). *Anadara granosa* L. is unisexual and our record shows that it reaches maturity in its first year at size range of 18-20 mm. The sexes appear to be in equal numbers and no sex change has been observed thus far.

From investigations that are still being conducted it would appear that in Penang the greatest number of adults with mature gonads occur from July to October. Maximum spawning also takes place within this period. In Perak, the spawning would appear to be later, as indicated by the later appearance of spat.

In Penang, spat appear in very large numbers from early August till mid-October and in smaller numbers thereafter. By October, the spat are 4-10 mm. in diameter and are ready to be collected for culture purposes.

LARVAL DISPERSION

Although there are extensive culture beds in the Eastern shores of Penang, yet spatfall has not been recorded in these areas. It is known that there is a comparatively strong tidal flow through the channel that is formed between the Island and the mainland. The direction of flow is north during the ebb and south during the flow. Drift bottle experiments have been conducted to determine the direction of local surface water movements from these areas. Further experiments are still in progress. From returns of bottles released it has been observed that those released with the flow to the South do not re-enter the channel, whereas those released with the ebb tend to move north but a good number have retraced the route from the point of release after moving north initially, and passed south. Further there is a tendency for these bottles to swing westwards along the south coast to the south-west tip of the Island. A few bottles have also been recovered from near to the natural beds on the West coast. This ultimate South-west drift might be the reason why spatfalls occur on the West coast of Penang.

GROWTH

Observations have been continued on the growth rate. It is conditioned by a number of factors such as nature of substratum, availability of food in the form of phytoplankton and density.

On the natural beds where density was less than one per square foot, *Anadara granosa* grows from a range of 4 - 10 mm. diameter to 18 - 32 mm. in 8 months, whilst on the culture beds where the density was 50 - 100/sq. foot, 10 - 12 months elapses before harvest began.

THE FISHERY

Since the introduction of culture in 1948, the fishery has expanded manyfold. In 1951 the acreage of foreshore under culture was less than a hundred. In November, 1955, official figures give the acreage as 860.5, and this had increased to 2,898 acres by November, 1957.

Culture consists essentially of three phases; the collection of spat, the subsequent transplantation and rearing to adult in culture beds, and finally the collection of adults for the market.

The Collection of Spat. When the spat attain 4 - 10 mm. diameter collection is begun. This is usually in October in Penang; it is later in Perak; and depending on the demand for culture purposes, collection is carried on till little if any spat are left in the beds.

The method of collection requires but the simplest equipment; a close set wire - scoop, a wooden trough or box, and sometimes a flat wooden board.

With these implements, the collectors set out for the beds in sampans with the ebb and return 2 - 3 hours before the full tid exposed mud the flat wooden board is us knee is placed on the board and the oth is used to push it through the mud. The or box is placed in the front of the bo the collection.

While collecting, using the bo wading in the soft mud which is knee t high, the scoop is swept through the su the mud a few times, then rinsed in wa and the cleansed shells deposited into ceptacle.

It is usual to work in groups o people. Sometimes it is a family gro skillful worker is capable of collecting 7 (4 - gallon kerosene tin), but the averag man is 5 - 6 hours. The collection is sold culturist.

As the collection often contain bottom living shells, the price per 4 kerosene tin varies depending on the abu of spat in the sample. As each collecto in his collection, the culturist examines lection and fixes the price which may va $3 - $7 per tin. Only during the fi weeks of collection is the best quality ob in quantity. Usually it is a mixture various grades; the lower grades predomi the season advances, and they contain a derance of other bottom living shells collection, particularly a species of (siput) as yet unidentified. (M$1/ = 2s

However, in spite of the poorer of seed cockle culturists buy as much is available.

The cost of a 4 - gallon kerosen 25 - 30 Katties, of seed cockles in relatio purity of the sample is given below:

Price/tin	% wt. seed cockles/kati	No. of seed cockles/kati	% wt. siput/ kati	$ wt. o shells/
$3.00	20 - 25	700 - 1,200	75 - 78	2
$4.00	25 - 40	1,200 - 2,000	50 - 65	6 -
$5.00	40 - 50	2,000 - 3,000	35 - 45	15 -
$7.00	over 50	over 3,000	20 - 30	15 -

1 kati = 1 1/3 lb.

Sowing and Rearing. The second phase of culture is the sowing and rearing to adult. Culture beds are in the main similar in nature to natural beds, but especial emphasis is paid to the nature of the bottom irrespective of other conditions. Immediately on arrival at the chosen site, be it even at the dead o sowing is begun. Boats loaded with s manned by 2 or 3 men one of whom mo boat slowly over the bed while the o others scatter the spat over the side of t with shovels. This is fairly skillfully do

n spread of spat is invariably obtained. and weedy patches of bottom are avoided; eas are known either by previous inspec- the beds, or the scatterers are directed an who examines the bed simultaneously.

Later the beds are inspected at low water y irregularity in the distribution of the evened out. In some beds this is all done till collection begins for the market months later. In others, as spat grow in e beds are thinned out by transplanting er areas. This results in a gradual e in the area under culture. Transplanta- sults in more rapid growth.

ting and Gear. Collection for the mar- gins 10-12 months later when the s attain marketable size of 24-30 mm. At ze, the cockles weigh about 60 to a kati. ar used for the collection resembles that hering spat, but the wires of the scoop farther apart. As culture beds often to deeper areas which are exposed only water springs, a long-handle scoop is ployed. The method of use of the board nd-scoop is similar to that in the collec- spat. When the long-handle scoop is ed, the fisherman stands in the boat and s the scoop as far as his reach allows. He ith a gentle rocking motion works the through the mud towards the boat. The s lifted through the mud towards the boat shaken vigorously to wash out the mud. atch are then deposited in the boat. A orking 5-6 hours can harvest on an e 10-12 bags of 110-120 katties each.

The beds are maintained by few men only. An area of 40 acres is worked by 3-4 men, and about a dozen men work on beds 250-300 acres in size. The whole bed is not worked over at the the same time, but in sections; as a section is denuded of its population and collection becomes difficult, other sections are started on.

To prevent pilferage at night one or the other of the collectors keeps vigil over the beds.

ENEMIES

It has been observed that at initial attempts at culture considerable mortality has occurred in a few beds. This has been due partly to the distance and the time taken to transport young cockles to the culture site; partly to predation by fish, especially skates, which clean out new beds completely, leaving but a few broken shells behind.

A boring mollusk, *Natica maculosa* (Siput bintang) occurs in natural beds and has been transported with the young cockles to culture beds. It attacks the young shells in the region of the umbo. However, mortality due to its predation is less than 1%. In culture beds with adult cockles these predators are rarely found.

ECONOMICS OF THE FISHERY

Except for the acreage of foreshore on lease for culture, no records of the quantity of spat collected and the amount purchased by individual culturists are available. However, the estimated figures in respect of annual production are given below:

	Penang Piculs	Perak Piculs	North Selangor Piculs
1952	—	27,030	—
1953	—	36,300	—
1954	—	32,670	—
1955	—	44,750	—
1956	—	78,309	—
1957	20,000	88,711	5,800
1958	Not available	64,781 (to Sept.)	6,250 (to Sept.)

(1 picul = 133.3 lb. = 60.60 kg.)

The total estimated production for the tion for 1957 is about 110,000 piculs, a more than twice that recorded for 1938 ublished data available before the War) stood at 43,000 piculs. The bulk of this production was consumed in the major towns of the the West Coast and in Singapore. The export of cockle to Singapore in 1956 was 2,973 tons (approximately 51,000 piculs or 50% of production) valued at $502,425 wholesale. The

corresponding figure for 1957 was 3,700 tons. As a direct result of this increased production, the canning of cockles in soya sauce which was demonstrated by the Fisheries Department before the war was taken up by two canneries, one in Penang and the other in Singapore. Singapore cannery drew its supplies of c in the form of cooked cockle-meat, in ice, from Perak.

Production Costs and Return. An evaluation of costs and financial return for a culture bed acres is given below:

Average cost of spat/4 gallon tin	— $4.00
Cost of sowing/4 gallon tin	— .20
" " collecting 2 bags adults	— 2.00
(one tin of spat will yield a minimum of 2 bags marketable cockles allowing for mortality by predation or otherwise. Each bag weighs 110-120 katties).	
Total outlay/tin	$6.20
Wholesale price for 2 bags of adult cockles derived from each tin of spat planted out	— $12.00
Therefore gross profit per tin planted out is	— $5.80

On a culture bed of 40 acres, it is usual to plant 5,000 to 6,000 tins of spat, thereby realizing a gross profit of $30,000 to $36,000 in one to two years depending on the rate of harvesting which is conditioned again by market demand. Since no major costs apart from paying for wages of a watchman during the growing period are incurred, the industry is obviously a very profitable one to the culturers. However, it must also be emphasized that the industry provides a considerable addition income of fishermen (men, women and ch in the fishing villages, particularly engaged in the collection of spat and harvesting of the adult cockle. In the bed off the West Coast of Penang, some 1 fisherfolk were engaged in the collection in the 1957 season, receiving about $60,0 the spat collected.

FOOD VALUE OF *ANADARA GRANOSA*

The weight of boiled meat from 1 kati of fresh Malayan cockles is given below fo and small sized cockles:

Table I. Meat Content of Malayan Cockles.

Size	Size range	No./kati	Whole weight	Boiled meat w
Large	38-47 mm.	22	1 kati (600 g.)	3.0 tahils (89 g.)
Small	28-34 mm.	56	1 kati (600 g.)	3.5 tahils (104 g.)

Table II shows the food value of the Malayan cockles as determined by the Gove Chemistry Department, Penang. It is compared with that of edible British mollusks and beef.

Table II. Food Value of Malayan Cockles

Constituents	Uncooked					Cooked				
	Water	Proteins	Fats	Ash	Carbo-hydrates	Water	Proteins	Fats	Ash	Carbo-hydrates
Oysters*	80.8	9.47	1.64	—	5.93	76.20	12.35	2.24	—	7.20
Cockles*	89.01	5.32	0.35	—	2.05	73.72	12.12	0.92	—	4.62
	64.70	18.70	15.70	0.90	0.50	?	?	?	?	?
a Cockles	76.30	12.30	1.4	2.80	7.20	78.20	12.50	1.30	1.90	6.10

(*Wright, F.S. 1956)

t will be thus seen that the local cockle l to other shellfish in food value, and es well with beef. Whereas one kati) of beef costs $2.00 M., the quantity les needed to give one kati of meat costs to 60 cents (Malayan).

UTILIZATION

The Malayan cockle is a popular food ble to all races in Malaya. The Malays boiled or cooked in curry whilst the consume it in great quantities boiled and ith chili sauce, or cooked with vermicelli. so canned in Soya sauce. As it is both at and cheap it provides a cheap and ource of much needed protein to the local

ACKNOWLEDGEMENT

Acknowledgement are due to the Chemistry Department of Penang for chemical analysis on cockle meat, to Professor R.D. Purchon for identifying the boring mollusk as *Natica maculosa* and to the field officers of the Department for Statistics of areas of natural and culture beds.

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A LIST OF COMMERCIAL FISHES OF INDONESIA *(Abstract)*

by
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MARINE FISHES

Family		*Scientific Name*		*Local Name*
GALEORHINIDAE	—	*Physodon mulleri*	—	Hiju Muara
		Eulamia melanoptera	—	Hiju Hitam
		Eulamia albimarginata	—	Hiju Putih
		Galeocerto cuvier	—	Hiju Matjan
SPHYRNIDAE	—	*Sphyrng zygaena*	—	Si Godam
TRYGONIDAE	—	*Trygon uarnak*	—	Pari
CLUPEIDAE	—	*Sardinella fimbriata*	—	Tembang
	—	*Sardinella allecia*	—	Lemuru
	—	*Hilsa toli*	—	Terubuk
DUSSUMIERIDAE	—	*Dussumieria acuta*	—	Djapuh
DOROSOMIDAE	—	*Dorosoma chasunda*	—	Selanget
ENGRAULIDAE	—	*Engraulis kammalensis*	—	Bulu Ajam
		Sthlephorus commersonii	—	Teri
		Setipinna breviceps	—	Biang-Biang
CHIROCENTRIDAE	—	*Chirocentrus dorab*	—	Parang
CHANIDAE	—	*Chanos chanos*	—	Bandeng
PLOTOSIDAE	—	*Plotosus canius*	—	Sembilang
ARIIDAE	—	*Arius thalassinus*	—	Manjung
BELONIDAE	—	*Tylosurus strongylurus*	—	Djulung-Djulung
EXOCOETIDAE	—	*Cypsilurus oligolepis*	—	Torani
POLYNEMIDAE	—	*Polynemus tetradactylus*	—	Senangin
SPHYRAENIDAE	—	*Sphyraena jello*	—	Alu-Alu
MUGILIDAE	—	*Mugil waigiensis*	—	Belanak
CENTROPOMIDAE	—	*Lates calcarifer*	—	Kakap
SERRANIDAE	—	*Plectropoma maculatum*	—	Lodi
	—	*Epinephelus tauvina*	—	Kerapu Lumpur
CARANGIDAE	—	*Megalaspis cordyla*	—	Tetengkek
	—	*Decapterus russelli*	—	Lajang
	—	*Decapterus kurroides*	—	Malalugis
	—	*Selaroides leptolepis*	—	Selar Kuning
	—	*Selar kalla*	—	Selar Batang
	—	*Garanx armatus*	—	Bubara
	—	*Parastromateus niger*	—	Dorang
	—	*Elagatis bipinnulatus*	—	Sunglir
CORYPHAENIDAE	—	*Coryphaena hippurus*	—	Lemadang
LEIOGNATHIDAE	—	*Letognathus splendens*	—	Peperek
MULLIDAE	—	*Upeneus vittatus*	—	Pinang-Pinang

NIDAE	—	*Lutjanus johni*	— Djenaha
	—	*Lutjanus sanguineus*	— Ikan Merah
	—	*Caesio erythrogaster*	— Ekor Kuning
NIDAE	—	*Otolithus argenteus*	— Djarang Gigi
	—	*Johnius diacanthus*	— Gulamah
MATEIDAE	—	*Pampus argenteus*	— Bawal Putih
IURIDAE	—	*Trichiurus haumela*	— Lajur
BRIDAE	—	*Rastrelliger neglectus*	— Kembung Perempuan
	—	*Rastrelliger kanagurta*	— Kembung Lelaki
JWONIDAE	—	*Euthynnus affinis*	— Deho
	—	*Katsuwonus pelamis*	— Tjakalang
NIDAE	—	*Neothunnus macropterus*	— Madidihang
	—	*Neothunnus rarus*	— Tongkol
IBEROMORIDAE	—	*Cybium commersoni*	— Tenggiri
	—	*Cybium guttatum*	— Tenggiri Papan

FRESHWATER FISHES

		Scientific Name	*Local Name*
PTERIDAE	—	*Notopterus chitala*	— Lopis
NIDAE	—	*Rasbora argyrotaenia*	— Wader Pari, Paraj
		Luciosoma trinema	— Djadjuo
		Leptobarbus hoeveni	— Djelawat, Ikan Lemak
		Cyprinus carpio	— Ikan Mas, Kerper, Tombro
		Dangila cuvieri	— Umbu, Milem
		Thynnichthys vaillanti	— Kendia
		Osteochilus hasselti	— Nilen
		Hampala macrolepidota	— Hampal
		Labeobarbus tambroides	— Tambra, Hampal
		Cyclocheilichthys apogon	— Redang, Lawak
		Puntius javanicus	— Tawes, Bader
		Puntius binotatus	— Beunteur, Wader
		Puntius orphoides	— Mata-Merah
		Puntius hexazona	— Ikan Kadis
		Puntius nini	— Pahat
IIDAE	—	*Clarias batrachus*	— Ikan Leleh
IDAE	—	*Wallago leerii*	— Tapah
	—	*Cryptopterus cryptopterus*	— Lais
ASIDAE	—	*Pangasius pangasius*	— Djuara, Djambal
IDAE	—	*Macrones nemurus*	— Singgal, Ikan Baung
JILLIDAE	—	*Anguilla australis*	— Sidat
RANCHIDAE	—	*Monopterus albus*	— Belut, Welut
CEPHALIDAE	—	*Ophicephalus striatus*	— Gaeus
ANTIDAE	—	*Anabas testudineus*	— Betok
		Polyacanthus hasselti	— Ketoprak
		Helostoma temmincki	— Tambakan, Biawan
		Trichogaster pectoralis	— Sepat-Siam
		Trichogaster trichopterus	— Sepat-Djawa
		Osphronemus goramy	— Gurami, Kelut
LIDAE	—	*Tilapia mossambica*	— Ikan Mudjair

THE MOTORISATION OF FISHING CRAFT AT VIET-NAM

by

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ABSTRACT

This communication alludes to some difficulties met during the first trials of motorization of fishing craft and shows how difficulties are finally overcome. Fishermen now much interested to mechanize their boats, and by way of guiding them to cho the motor suitable for their boat, the author makes available to fishermen, a list of engi ranging from 6 h.p. to 120 h.p. with the corresponding specifications of wooden boats.

INTRODUCTION

Le riz et le poission sont, pour les Vietnamiens, la base de leur nourriture quotidienne. Ils se privent facilement de viande pendant plusieurs mois de l'année, mais ne peuvent pas se passer du poisson, denrée qui entre dans leur alimentation sous différentes formes : frais, sec, salé, sauce, pâte conservée avec du sel etc ... Etant ichthyophages, les Vietnamiens se sont livrés avec ardeur à la pêche depuis des temps très anciens et sont favorisés d'autre part par les conditions géographiques du pays : plus de 2.000 km. de côtes, réseau très serré de rivières, canaux etc...

En dehors des pêcheurs de métier qui font de la pêche le moyen principal de leur subsistance, on peut dire aussi qu'au Vietnam chaque paysan, quelque soit son métier, est doublé d'un pêcheur. L'agriculteur, le fermier, l'ouvrier ... vivant à la campagne, le long de la côte ou à la bordure des rivières, possèdent toujours quelques petits engins de pêche dont ils se servent en dehors de leurs occupations principales.

Les statistiques d'avant guerre enregistraient une population pêcheur d'environ 500.000 habitants sur 25 millions de la population totale du pays et une quantité de barques de pêche s'élevant jusqu'à 37.000 unités. Ces chiffres témoignent de façon éloquente l'intérêt, même l'instinct, du peuple vietnamien à l'exploitation des ressources naturelles aquatiques.

Bien qu'importante, l'industrie de la pêche, jusqu'à la fin de la deuxième guerre mondiale, était malheureusement oubliée, pendant que les autres branches d'activité économique du pays avaient reçu beaucoup de soins de la part du Gouvernement. Les pêcheu laissés à leurs propres et traditionnels m devant la Nature parfois peu hospitalière sont légués de père en fils des tech inchangées depuis des siècles. De modifications sont apportées par qu pêcheurs régionaux pour rendre leur équi propre aux conditions climatologiques l mais il n'existe pratiquement pas de c ment notable en ce qui concerne la tec fondamentale.

Il en est de même pour les barq pêche. Avant 1953, date de la création Direction des Pêches au Vietnam aucune de pêche n'est motorisée. La rame et l sont les seuls moyens de propulsion u Cet état de chose fait perdre un temps culable et diminue beaucoup la possib production des pêcheurs.

LES PREMIERS ESSAIS DE MOTORISA

Vers le début de l'année 1956, g "l'Aide Economique Américaine", la Di des Pêches a importé 20 moteurs marins de 8 à 12 cv., de marque japonaise, pour de lancer le mouvement de la motorisat barques de pêche. Nous nous doutons p de la collaboration immédiate et sans des pêcheurs qui sont souvent, comme da les pays, fidèlement attachés à leurs méthodes et ennemis du modernisme. pour les encourager dans la nouvelle voi leur réservons des conditions d'acha avantageuses :

a/-Seuls les pêcheurs de métie considérés comme les premiers ayant Les mareyeurs-ramasseurs de poisso transporteurs ou revendeurs des produ

par voie maritime ou fluviale, ravitaillant
tites localités peu accessibles par voie
e, ne sont classés respectivement qu'en
me et troisième priorité.

b/-Le prix des moteurs cédés aux pêcheurs
ut à la moitié de leur valeur à l'importa-
L'autre moitié est considérée comme un
d'encouragement que le Gouvernement
e aux premiers acheteurs.

Le paiement n'est pas obligatoirement
ant. L'acheteur peut demander à payer en
termes trimestriels.

Malgré ces avantages, beaucoup de
urs hesitaient encore, invoquant des pré-
les plus divers tels que : le moteur
ira la barque et gênera les opérations de
le bruit du moteur effraie et chasse les
ns, celui qui possède une barque motorisée
as admis à travailler dans la même zone
s collègues à cause du bruit du moteur
D'autres pêcheurs, sans être convaincus
vantages possibles des moteurs, mais
ssés par le prix relativement bas proposé
Direction des Pêches, demandent à les
r avec l'intention de les revendre par la
cherchant à réaliser ainsi quelques petits
ces immédiats.

Les hésitations des pêcheurs constituent
ers obstacles de début mais finalement les
rs sont vite vendus et après 6 mois d'essai,
is de défaillance ne sont plus que de
es ombres" rapidement effacées par les
its concrets et économiques qu'apporte le
r au propriétaire de la barque. Les
ents à bons termes et même par anticipa-
es 20 prsmiers moteurs, les nombreuses
des d'achat de nouveaux moteurs sans
reçues à la Direction des Pêches témoig-
argement l'intérêt que portent maintenant
cheurs à cette question.

GOUVERNEMENTALE AUX PECHEURS

L'esprit empirique et la réticence des
urs à ce propos, peuvent donc être consi-
comme déjà vaincus, nous passons main-
au stade d'extension, de guide et d'aide
pêcheurs. L'aide gouvernementale peut
lans ses grandes lignes, divisée en 2
s :

1. — Aide technique
2. — Aide financière

1. AIDE TECHNIQUE

a/-Choix des moteurs ad-hoc à chaque barque de pêche. - La propagande ou l'octroi des primes d'encouragement pour donner l'élan à la motorisation des barques n'est plus nécessaire. Le pêcheur a maintenant besoin plutôt d'un guide lui permettant de choisir un moteur ad-hoc à chaque barque de pêche, car laissé à ses propres initiatives, le pêcheur, par ignorance ou par amour-propre, a très souvent choisi un moteur qui ne convient pas à sa barque. Son choix, basé sur les expériences des quelques barques motorisées de son village est fort possible sujet à des erreurs, car ces barques étaient elles-aussi motorisées au plus grand hasard.

D'autres pêcheurs ont tendance à chercher un moteur plus grand qu'il ne le faudrait, espérant qu'un grand moteur peut faire de la vitesse et en conséquence lui rapporter davantage. Au retour de chaque pêche, il existe en effet une sorte de course entre les barques d'une même région vers le port d'attache pour mieux vendre leurs poissons dont les premiers mis en vente au marché ont toujours un prix meilleur que ceux qui viennent plus tard. Il est vrai qu'avec un moteur puissant, le pêcheur aura plus de chance de rentrer en tête de file mais il est aussi vrai que, pour augmenter de quelque peu la vitesse, il aurait besoin d'un moteur bien plus puissant qu'il ne le faut et que l'opération lui reviendra cher avec le prix d'achat du moteur, ses frais d'installation d'entretien et de fonctionnement. Il oublie aussi que la rapidité d'une embarcation est conditionnée par la solidité de sa coque, et que l'excès de vitesse ne fait que nuire aux barques on bois par suite des violentes secousses subies.

Des fois l'amour-propre du pêcheur qui veut que sa barque motorisée ne soit jamais battue par aucune autre barque à voile, trouve sa place non moins importante dans ce jeu.

Pour mettre un terme à cette conception erronnée de certains pêcheurs et pour les guider dans le choix d'un moteur dont la puissance est propre au tonnage de leurs barques, la Direction des Pêches du Vietnam, avec l'aide du technicien japonais Mr. K. KATAYAMA, a établi la liste ci-dessous donnant les dimensions, le jaugeage de chaque catégorie de barque avec la force motrice des moteurs marins Diesel correspondant :

POUR MOTEURS MARINS DIESEL IN-BORD *(Type Japonais)*

Force motrice	Dimensions en mètres			Tonnage brut en tonne métrique	Tonnage de déplacement	Vit noeu
	Long. entre perpend	Largeur	Profondeur			
6 cv.	6,00 - 7,50	1,40 - 1,70	0,61 - 0,75	1,500 - 2,000	1,250 - 2,400	6,2 -
8 —	7,20 - 8,70	1,60 - 1,98	0,71 - 0,86	1,750 - 3,150	2,000 - 3,720	6,5 -
11 —	8,00 - 9,11	1,80 - 2,10	0,79 - 0,99	2,400 - 3,600	2,880, - 4,320	7,2 -
15	8,80 - 10,10	1,98 - 2,30	0,86 - 1,00	3,150 - 4,800	3,750 - 5,760	7,3 -
16	9,00 - 10,30	2,04 - 2,34	0,89 - 1,00	3,42 - 5,15	4,800 - 6,200	7,6 -
22	9,90 - 11,30	2,24 - 2,57	0,89 - 1,12	4,400 - 6,800	5,200 - 8,100	7,8 -
30	10,9 - 12,50	2,57 - 2,84	1,07 - 1,20	6,00 - 9,00	8,900 - 13,600	7,9 -
45	12,35 - 14,10	2,80 - 3,21	1,21 - 1,31	8,000 - 13,200	1,800 - 19,500	8,0 -
60	13,50 - 15,50	3,07 - 3,52	1,33 - 1,52	11,500 - 17,300	17,00 - 25,60	8,4 -
75 —	14,00 - 16,00	3,18 - 3,64	1,48 - 1,70	13,800 - 20,700	20,700 - 31,000	8,8 -
90 —	15,00 - 17,00	3,41 - 3,86	1,59 - 1,80	17,00 - 24,00	25,500 - 34,00	9,1 -
120 —	16,50 - 19,00	3,75 - 4,32	1,75 - 2,10	23,100 - 36,800	41,500 - 66,200	9,0 -
			Pour Moteur Essence Hors-Bord *(Type motogodille)*			
6 cv.	4,90 - 5,50	1,10 - 1,20	0,49 - 0,55	0,69 - 0,95	1,085 - 1,160	8,9
10 cv.	5,50 - 6,10	1,20 - 1,40	0,55 - 0,61	0,95 - 1,35	1,160 - 1,610	10,5

N.B. — Le bois de "Sao" (Shorea cochinchinensis) étant généralement utilisé pour la fabrication des barques de pêche au Viêtnam

b/-**Installation des moteurs.** - L'installation des moteurs dans la barque attire également notre attention particulière, car l'efficacité du moteur, sa vie, celle des passagers et des équipages en dépendent pour une très large part.

Au Vietnam si la flotte de pêche ne commence à être dotée de moteurs que pendant ces dernières années, les services des transports fluviaux ont connu le moteur depuis assez longtemps mais les seuls artisans chargés de l'installation de ces moteurs sur les barques de transport sont les mécaniciens et menuisiers régionaux qui font le travail d'abord à tâtons, puis par habitude. Une enquête, faite sur 30 barques motorisées dans une région se t à 250 Km de Saigon, revèle que da ensemble, l'installation des moteurs n pas beaucoup à désirer, seuls quelques ont besoin d'être améliorés.

Pour mieux le faire à l'avenir, la tion des Pêches se propose d'envoye demande des intéressés, un technicie tous les centres de pêche, accomplir travail d'installation pratique du mote barque. Le technicien sera entouré, toute la durée de son travail, de me et de mécaniciens de la place; il se ch leur montrer comment il faut chosir un et comment l'installer convenablement. qui ont déjà une notion générale sur mo leur installation, peuvent de visus appr corriger les erreurs qu'ils ont, dans l commises par ignorance.

Ce que nous cherchons c'est qu'après son le technicien laisse dans chaque centre che, au moins quelques hommes capa- d'installer et d'entretenir des barques sées.

c/Utilisation et entretien des moteurs. - urs itinérant pour l'utilisation et l'entre- es moteurs est organisé à l'intention des urs dans les centres de pêche. La durée pour chaque cours est de 30 jours ue duquel les élèves, ayant passé avec un test, obtiennent un certificat de té qui leur donne priorité à tout achat iel des moteurs marins cédés par la Direc- es Pêches.

d/-Essai de motorisation des barques en ou. - Les pêcheurs, surtout ceux de la orientale du Vietnam, utilisent un très nombre de barques de petit tonnage T.) dont le fond, à partir de la ligne de son, est en bambou tressé. Ce type de le légère est commode pour l'usage de la et de la rame et surtout commode pour oussée sur les plages de sable au mauvais ou au moment de réparation mais n'est i tout adaptée à la motorisation.

Toutefois une firme japonaise vient de mettre au point un genre de moteur Diesel de faible puissance à piston horizontal, qui, d'après les experts, pourra bien être utilisé sur les barques en bambou tressé. La Direction des Pêches du Vietnam a fait une commande de quelques unités et procédera à des essais sur les barques légères dans le courant de l'année 1959.

2. AIDE FINANCIERE

Avec leurs statuts approuvés par le Gouvernement qui leur consent en plus des prêts prélevés sur le "Crédit de Pêche" les coopératives réunissent ainsi des conditions de garantie suffisante de paiement leur permettant d'acheter par termes des équipements de pêche. Quelques maisons importatrices ont déjà signalé leur accord de vente par termes les moteurs marins dont les conditions seront ultérieurement fixées avec les coopératives et suivant chaque cas spécifique. Le Conseil d'Administration des Coopératives sera le seul signataire responsable vis-à-vis du vendeur en ce qui concerne le paiement des moteurs qu'il revend aux pêcheurs.

FISHING EFFICIENCY OF OTTER TRAWL AIDED WITH A KITE

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ABSTRACT

Designed on the basis of model experiments for studying hydraulic resistan and other effects on the net configuration, the kite under report was proved capable of lift the mouth of a trawl with a 146 ft. head line, twice as high as without the kite. On the ba of average catch per day during the 1956-57 and 1957-58 seasons, fishing efficiency w compared between the kite trawl and ordinary ones, both operated for prawn in the E China and Yellow Seas. When boats of different capacities (270, 300, and 500 gross ton were operated on a comparable basis, the kite trawler of 360 gross tons was found supe in the amount of catch to any other boat operating without the kite. It has been confirm that use of the kite could augment the catch of the prawn one half or twice over the ordin boat operating in the trawling grounds in these waters.

INTRODUCTION

A kite is a device to lift up the mouth of a trawl under operation so as to increase fishing efficiency. The device has already been in use by trawlers in the seas around North Europe. However, references at hand show no accounts of a kite which was designed and constructed on the basis of theoretical research into efficient configuration of the net.

Model experiments conducted at a laboratory tank for years resulted in materialization of a kite reported in this paper. After successful field tests in Tokyo Bay by the R.V. *TARU MENYO* (240 G.T.) of the Tokai Regional Fisheries Research Laboratory, the kite has been in commercial use in the East China and Yellow Seas since February 1957.

MATERIALS AND METHODS

Construction

As the present paper aims at comparing fishing efficiency between the kite trawler and the control, the author refers to a previous paper (Takayama *et al.*, 1957 : 2-10) for theoretical aspects of the study leading ultimately to construction of the kite. However, it may be convenient for the reader to summarize important points about the kite below.

1. In the ordinary trawl with the head line measuring 146 ft., the mouth usually opens about 2 meters. For the purpose of lifting up the height twice as much, different types of kites were designed on a miniature scal subjected to a series of tank e ments together with a model ne measurement of the most e type was converted into a ful size, 130×93 cm. The full sca made of wood weighed 80 kg operative efficiency of thi observed in the field with th of an echo sounder was con with that obtained in the tank e ments.
2. In trawling with the kite at 3-4 iron chains, 1.2 cm. in diamet about 40 m. in length, have added to the ground rope so may sweep along the bottom. length of the false head rope on the kite would slide must be cent of the head rope; the conn rope is about 3 m. long betwe lower corners of the kite an square.
3. When furnished with a kit gussets, the distance betwee wings became about 3-4 m. s The gusset is a triangular pi net inserted between the end square and the posterior end wing to hold the mouth of t high without straining it when up by the kite.
4. The shape of the nets has been almost similar in the model a field experiments.

Source of Data: In the East China and ... Seas the prawn *(Penaeus orientalis* ...ouye) is important for numerous Japanese ...rs operating there during the season from ...December to ensuing April. With relatively ...ent knowledge made available on the ...al migration of this species, this prawn ...ce was well protected under an interna... voluntary agreement which was effective ...en the fishermen of the interested ...ies throughout the period under report.

In the present work examining efficiency ... trawling, the catch data of three trawlers, each equipped with a kite of the above description have been compared with those obtained from 14 ordinary trawlers, both types of boat having operated for prawn under nearly the same conditions as to season and locality.

RESULTS AND DISCUSSION

General Decrease in Catch: The total catch of prawn, more or less fluctuating from year to year, showed a decrease of 30 per cent in the 1957-58 season from the preceding season, as far as the fishery statistics of Japan are concerned.

Table 1. Comparison of Prawn Catch by Non-Kite Trawlers (270 G.T.) of T. Company, 1956-57 and 1957-58 Seasons.

...me ...of ...ip	December 1957 to April 1958			December 1956 to April 1957		
	Total catch (case)★	Number of fishing days	Mean catch per day (case)	Total catch (case)	Number of fishing days	Mean catch per day (case)
B 1	2,079	81	25.7	7,175	115	62.4
B 2	4,401	103	42.7	5,221	103	50.7
B 3	3,930	90	43.7	7,784	102	69.5
B 4	3,570	88	40.6	6,546	114	57.4
B 5	4,256	97	43.0	8,180	117	69.9
			Mean : 39.3			Mean : 62.0

In the case of non-kite trawlers of 270— ...ss the decrease in the catch per day in the ...shing season compared to the 1956-57 season was 63%; 300-ton class had a decrease of 73%, and 500-ton class, 81% (Table 1, 2 and 3).

Table 2. Comparison of Prawn Catch by Non-kite Trawlers (300 G.T.) of N. Company, 1956-57 and 1957-58 Seasons.

...me ...of ...ip	December 1957 to April 1958			December 1956 to April 1957		
	Total catch (case)★	Number of fishing days	Mean catch per day (case)	Total catch (case)	Number of fishing days	Mean catch per day (case)
B 1	4,807	130	36.9	7,431	121	61.4
B 2	5,522	109	50.7	7,410	131	58.7
B 3	4,036	113	44.5	8,211	129	63.7
			Mean : 44.0			Mean : 60.1

★ Case = Headless 100 pieces, approximately 4.76 kg.

In the absence of conclusive evidence, one may take the liberty of attributing this phenomenon to changes in ocenographic fishing conditions.

Table 3. Comparison of Prawn Catch by Non-Kite Trawlers (500 G.T.) of T. Con 1956-57 and 1957-58 Seasons.

	December 1957 to April 1958			December 1956 to April 1957		
Name of ship	Total catch (case)★	Number of fishing days	Mean catch per day (case)	Total catch (case)	Number of fishing days	Mean ca per da (case
Tc 1	5,157	125	41.3	5,460	93	58.7
Tc 2	3,578	76	47.1	4,068	80	50.9
			Mean : 44.2			Mean : 54.8

Comparative Efficiency:

Compared with that of a non-kite boat of the same tonnage, the catch per day of a kite trawler (360 gross tons) in the 1957-58 season was almost as good as in the preceding season, while the catch of the latter showed a decrease. The fact that the kite trawler had steady yields during both seasons while there was a general decrease in the catch in one season after a seems to speak in favor of the kite (Ta In the same months of 1957-58 season, t trawler (360 gross tons, 700 HP) harves times as much as the non-kite trawler identical capacity, again demonstratin advantage of the kite (Table 4).

Table 4. Comparison of Prawn Catch by Types of Trawlers, 1956-57 and 1957-58 Se

Type of Vessel	Fishing Season	Name of ship	Total Catch (case)★	Number of Fishing Days	Mean Ca per Da (case)
Kite trawler of	December	TAK 1	6,566	98	67.0
360 G.T. type	1957	TAK 2	7,617	97	78.5
	to	TAK 3	7,779	96	81.0
	April				
	1958				Mean : 75.5
Non-Kite trawler	December	TA 1	9,648	114	84.6
of 360 G.T. type	1956	TA 2	6,286	96	65.5
	to	TA 3	7,898	104	75.9
	April				
	1957				Mean : 75.3
Non-Kite trawler	December	NA 1	4,852	102	47.6
of 360 G.T. type	1957	NA 2	6,365	115	55.3
	to	NA 3	4,459	115	38.8
	April	NA 4	5,497	92	59.7
	1958				Mean : 50.4

★ Case = Headless 100 pieces, approximately 4.76 kg.

Where the catches per day throughout 957-58 season of the 360-ton kite-trawler non-kite trawlers of different sizes, are ared, the superiority of the former becomes all the more evident as the haul is either 1.9 times greater than a non-kite boat of 270 tons or 1.7 times greater than another boat of 500 tons (Table 5).

Table 5. Comparison of Prawn Catch by Type of Trawlers, 1957-58 Season.

Type of Vessel	Name of Ship	Total Catch (Case)★	Number of Fishing Days	Mean Catch per Day (Case)
Kite trawler of	TAK 1	6,566	98	67.0
360 G.T. type	TAK 2	7,617	97	78.5
	TAK 3	7,779	96	81.0
				Mean : 75.5
Non-Kite trawler	TB 1	2,079	81	25.7
of 270 G.T. type	TB 2	4,401	103	42.7
	TB 3	3,930	90	43.7
	TB 4	3,570	88	40.6
	TB 5	4,256	97	43.9
				Mean : 39.3
Non-Kite trawler	TC 1	5,157	125	41.3
of 500 G.T. type	TC 2	3,578	78	47.1
				Mean : 44.2

It may be worth noting that the trawling n varies depending on time of the day, even e same size of boat with or without the kite. n this fact in mind, the average catch per during day time and night for both types of ler (360 tons) has been compared. The of catch per haul by day between them was 100, and that by night 141:100. The s may be interpreted as an evidence proving the kite-type trawling is effective for the day operation just as well at night as long as it aims at those groups of fish swimming on a layer five or six meters above the sea-bed.

REFERENCES

TAKAYAMA, S. and T. KOYAMA (1957). Studies on the trawl net-I: A net-mouth stretcher working on the kite principle. *FAO Internat. Fish Gear Cong. 1957, Hamburg.*, Paper **39** (b): 13.

★ Case — Headless 100 pieces approximately 4.76 kg.

EXPERIMENTS ON FISHING NET PRESERVATION

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ABSTRACT

Tests of the effectiveness of several methods of preserving fish net twines we carried out over several months at the Gear Wing of the Central Fisheries Technologic Research Station at Cochin, India. The tests were carried out in the warm backwaters twines made of cotton and sun hemp.

The results show that where all the preserving agents gave poor protection when us alone, much better results were obtained when used together with another agent. F instance, twines treated with an extract from Indian "panichikka" bark were rotten aft 20 days; but when such treated twine was subsequently dipped in coal tar, it was found th after 57 days continuous immersion the twine still retained 74% of its breaking strength.

INTRODUCTION

It is common knowledge that fishing nets deteriorate either while in use or in storage. The weakening of fibres of the fishing nets is caused by physical wear and tear, bacterial infection, action of organic matter like the fish slime, dead fish etc. and temperature. All methods of preservation of fishing nets are meant to slow down the process of deterioration. The Indian fishermen since ages are known to keep their fishing gear in good condition as long as possible, by treating them with some form of vegetable matter like the fruits, the nuts, the leaves and the bark of several trees. Though considerable progress has been made in other countries in the manufacture of net preservatives on a commercial scale and in the study of their advantageous application to different types of fishing gear, no systematic work has been done in India and other tropical countries, even on a study o vast resources of vegetable products in diff forms available in large quantities and us different parts of the country, the metho preservation adopted in each case, how fa nets become strengthened by the applic of these preservatives, the preserving qualit each preservative etc. Attempts have made, therefore, in a series of experi described in this paper for a study of the details and to observe how far they compare the preservatives used in other parts of the w The preservative value of different comm products together with coal tar, kerosene local kinds of bark, was tested during experiments. Commercial products are signated in this paper as "Product "Product B" etc.

SERIES 1: PRODUCT A, PRODUCT B, COAL TAR AND THREE LOCAL PRESERVATIVES

MATERIALS AND METHODS

Twines Tested:

The twines used in these experiments had the following specifications:

1. Material: Russian cotton twine, No. 32, 18 threads, 3 ply and soft twisted.

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Tsukishima, Chuo - ku, Tokyo, Japan.

2. No of twist: Outer (clockwise) 100, inner 80 per foot.
3. Weight: 0.534 g. per meter.
4. Thickness (Diameter): 1.04 mm.
5. Breaking strength in lb.:

	Average	*Maximum*	*Minimum*
In dry condition *	15.39	17.50	13.75
In wet condition * *	16.21	17.50	15.00

6. Breaking strength in wet condition / Breaking strength in dry condition = 1.06

One bundle of fifty pieces of the twines of the above specifications, weighing 38 g. in nd about 54 in. in length was treated in each of the preservatives of this series.

rvatives Experimented:

Coal tar, 2 commercial products and three of local preservatives were experimented s series. Detailed information about these rvatives, their application to fishing gear, and storage after treatment etc., are hed in Appendix I. Details of treatment ese preservatives as applied in this of experiments are, however, described separately.

1. **Product A (a copper compound): ene = 1:6.** Thirty cc. of product A were to 180 cc. of kerosene in a metal con- and stirred well. The cotton twine e was dipped in this 210 cc. of pale green n and turned over well for about five es so as to uniformly impregnate the ial with the preservative. The cotton e was then lifted up from the container fter draining the excess preservative, it read freely on a cotton line and dried in for about six days. The twines so treated ried were pale green in color, soft and e, but found shrunk by about 5 in. in . The pale green colour was coming off ly to hard touch.

2. **Product A: Kerosene = 1:4.** Forty cc. duct A were added to 160 cc. of kerosene e twines treated and dried as in 1. The d twines were observed to be similar in ter to those in 1.

3. **Product A: Kerosene = 1:2.** Sixty ml. of product A were added to 133 ml. of ne and the twines treated and dried as in he twines so treated were similar to those except that the twines were a little darker in color.

4. **Coal tar: Kerosene = 3:1.** One hundred and fifty cc. of coal tar were added to 50 cc. of kerosene in a metal container and stirred well. The composition of coal tar was not analysed. One twine bundle was dipped, and turned well for about 10 minutes in the thick black solution obtained without heating it. After draining the excess solution, the twines were hung separately in shade to prevent sticking to each other and dried for about 6 days. The treated twines were black in color, heavy, rigid and shrunk by about 6 in.

5. **Product A and coal tar:** One bundle of cotton twine treated with one part of product A and two parts of kerosene as in 3 and dried for only one day was dipped, pressed and turned for about 10 minutes, in a bath of 3 parts of coal tar and one part of kerosene (as prepared in 4). The excess liquid was then drained well and the twines hung separately in shade. Drying of the twines was complete after about 6 days and the twines were black in color, heavy rigid and shrunk by about 6 in. as those in 4.

6. **Product B (a tar or asphalt derivative dissolved in Shell mineral turpentine): Kerosene = 6:1.** Three ounces of kerosene were added to 18 ounces of product B in a metal container, stirred well and heated to about 60°C. The twines were pressed in the hot, fairly viscous black liquid obtained and turned for about 10 minutes. After draining off the excess liquid, the twines were separately hung in shade for 6 days when they were completely dried. The twines were then black in color, very heavy and stiff. They had also shrunk by about 6 in.

*average of 15 tests.
**twine dipped in water for more than 24 hours and average of 13 tests taken.

7. **Myrobalan nuts** *(Terminalia* species*)*: Three hundred of water were added to ¼ lb. of well powdered dry shells of these nuts in a metal container and boiled for about 15 minutes. The hot extract was then filtered and the residual powder pressed well in a piece of cloth to collect more extract. The twines were then dipped in a saffron brown solution obtained, turned well over and kept pressed in it for about 12 hours. After draining off the excess solution, the twines were then hung freely in shade. When dried after two days, the twines were redyed and dried as above. The redyed twines were brownish saffron in color, stiff and shrunk much by about 12 in.

8. **"Panichikka"** (Fruits of *Diospyros embryopteris*): One pound of these green fruits was crushed to a paste and stirred well with 200 cc. of water. The extract was then filtered and the twines immersed, turned and kept pressed in the purple colored sticky extract obtained, for about 12 hours. They were then dried in shade for about 2 days. The twines were redyed and when dried were purple in color, hard, very rigid and found shrunk to about 9 in.

9. **Bark of "Kalasam"** *(Odina wodier):* Four ounces of dried bark were crushed well and boiled with 500 cc. of water for about 15 minutes. The extract was filtered and the residual hot bark pressed in a piece of cloth to collect all the extract. The twines were then dipped in the hot brick red solution obtained, turned well and kept pressed in it for about 12 hours. The twines were then hung freely and when dried in sun for about 6 hours, they were re The redyed twines dried for 2 days became brick red in color. They were light, fl and soft, but shrunk by about 9 in.

10. **Bark of "Kalasam" and Coc** The twines treated and dried as in item 9 dipped in a coal tar bath as prepared in i (3 parts of coal tar and 1 part of kerosene after turning the material well for ab minutes, they were hung separately in shad dried for about 3 days. When dry, the t were black in color and heavy. They also found shrunk by about 9 in.

RESULTS

Impregnation of Preservatives into the C Twines:

As mentioned earlier, a bundle pieces of cotton twines, weighing in all 38 treated with each preservative. After d each bundle was weighed again and the centage impregnation of each presen calculated. Results are given in Table I. data are very valuable to assess the wei fishing gear after treatment, The impreg of the bark extracts was found the lowest i series of experiments while those of coal t product B were the highest and the t increased in weight nearly twice after trea with them. The impregnation of Prod plus kerosene in different ratios, product A coal tar, and bark plus coal tar were propor to the quantities of product A, bark an tar used.

Table 1. Percentage impregnation of preservatives.

S. No.	Preservative	Weight in g. of dry bundle of twines after treatment	Difference in weight (in g.) before and after treatment	Impregnati of the prese vative (in
1	Product A : Kerosene = 1:6	47.30	9.30	24.5
2	Product A : Kerosene = 1:4	52.97	14.97	39.5
3	Product A : Kerosene = 1:2	62.41	24.41	64.3
4	Coal tar : Kerosene = 3:1	72.31	34.31	90.0
5	Product A ; Coal tar	89.39	51.39	135.0
6	Product B	76.21	38.21	101.0
7	Myrobalan nuts	62.60	24.60	65.0
8	"Panichikka"	55.10	17.10	45.0
9	Bark of "Kalasam"	40.39	2.93	7.7
10	Bark of "Kalasam" plus coal tar	73.81	35.81	94.3

ng Strength Tests (in Wet Condition)
naracteristics of Twines:

When dried well, the twines of each treated as well as one untreated (control) were separately hung in iron frames 1.57 from a bamboo raft anchored in backwaters. The figures in Appendix lain the details of the raft and frames. twines were removed from the frames at nt periods and tested for breaking th in wet condition. The breaking th tester used was designed and cons- l at the Station. Average of nine tests ken in each case and the results are given le 2.

It will be seen from Table 2 that the ng strength of all twines increased after treatment. But when these twines were subjected to continuous immersion in the backwaters, the fall in the breaking strength of those twines treated with Myrobalan nuts, product B and bark of "Kalasam" were observed to be steep. Those treated with product A, "Panichikka" however took about 20 days to rot. The fall in breaking strength of twines treated with coal tar, product A plus coal tar, and bark of "Kalasam" plus coal tar, however, was fairly gradual; while the breaking strength of the first fell to 3.1 lb., that of the second fell to 4.9 lb. after 50 days of continuous immersion in backwaters. The frame from which the third sample twines were hung was lost from the bamboo raft unfortunately and hence no data could be gathered.

Table 2. Relation between breaking strength of samples twines and number of days immersed.

Preservatives in which the twines were treated	Breaking strength in lb. at different periods								
	On treatment 6 Nov.	7 days 13 Nov.	12 days 18 Nov.	17 days 23 Nov.	20 days 26 Nov.	27 days 3 Dec.	35 days 11 Dec.	43 days 19 Dec.	50 days 26 Dec.
1	2	3	4	5	6	7	8	9	10
1. Control (untreated)									
Aver.	16.21	6.60	1.30	Rotten	—	—	—	—	—
Max.	17.50	12.00	5.00	—	—	—	—	—	—
Min.	15.00	2.00	1.00	—	—	—	—	—	—
2. Product A : kerosene = 1:6									
Aver.	17.38	6.90	2.30	1.40	Rotten	—	—	—	—
Max.	19.20	9.50	4.50	2.50	—	—	—	—	—
Min.	14.40	5.50	1.00	0.50	—	—	—	—	—
3. Product A : kerosene = 1:4									
Aver.	20.42	13.00	4.10	0.70	Rotten	—	—	—	—
Max.	21.60	19.30	7.00	1.50	—	—	—	—	—
Min.	18.75	7.00	1.00	0.00	—	—	—	—	—
4. Product A : kerosene = 1:2									
Aver.	19.40	10.30	3.00	1.80	Rotten	—	—	—	—
Max.	21.10	14.90	6.00	4.50	—	—	—	—	—
Min.	17.30	7.30	1.00	0.00	—	—	—	—	—
5. Coal tar : kerosene = 3:1									
Aver.	16.94	10.30	8.14	9.50	7.91	6.63	6.80	3.80	3.1
Max.	18.70	12.30	15.75	16.60	16.50	10.80	12.50	6.20	7.0
Min.	15.80	8.30	7.75	1.50	1.00	2.50	1.50	0.00	0.00
6. Product A : coal tar									
Aver.	17.00	10.50	12.60	15.26	12.26	9.11	5.20	6.40	4.00

the twines were treated	On treatment 6 Nov.	7 days 13 Nov.	12 days 18 Nov.	17 days 23 Nov.	20 days 26 Nov.	27 days 3 Dec.	35 days 11 Dec.	43 days 19 Dec.	50 days 26 Dec.
1	2	3	4	5	6	7	8	9	10
7. Product B									
Aver.	16.67	2.80	0.90	Rotten	—	—	—	—	—
Max.	17.30	7.70	3.00	—	—	—	—	—	—
Min.	14.90	0.50	0.50	—	—	—	—	—	—
8. Myrobalan nuts									
Aver.	19.33	0.25	Rotten	—	—	—	—	—	—
Max.	21.10	0.25	—	—	—	—	—	—	—
Min.	17.30	0.25	—	—	—	—	—	—	—
9. "Panichikka"									
Aver.	19.13	19.00	2.10	0.30	Rotten	—	—	—	—
Max.	20.65	21.00	3.00	0.50	—	—	—	—	—
Min.	18.00	16.40	0.50	0.00	—	—	—	—	—
10. Bark of "Kalasam"									
Aver.	18.43	11.30	1.70	Rotten	—	—	—	—	—
Max.	20.30	16.20	4.00	—	—	—	—	—	—
Min.	16.30	3.40	0.50	—	—	—	—	—	—
11. Bark of "Kalasam" plus coal tar									
Aver.	19.60	16.40	17.47	18.40	18.49	Lost	—	—	—
Max.	21.10	18.50	18.00	19.20	19.50	—	—	—	—
Min.	17.80	14.70	16.00	17.20	17.00	—	—	—	—

Except the twines treated with myrobalan nuts which lost both the brownish saffron colour and the stiffness, when kept in water for about 24 hours only the original characteristic colour and stiffness of the other twines were almost retained in all cases even in rotten condition; the preservative was found hard on the twines and was not coming off from the rotten twines also. Those treated with "Panichikka" and the bark of "Kalasam" were observed comparatively swollen after 17 days in water. The lower halves of all the sample twines were observed to be coated with brownish vegetable coating after seven days and with vegetable growth after 20 days immersion in backwaters and were comparatively weaker than the upper halves. This coating and growth gr increased on the twines as the imm continued.

Percentage Breaking Strength of Twines Experimented:

With the breaking strength of un twines in wet condition (after immers fresh water for about 24 hours) taken the percentage breaking strength of treated twines were calculated and are gi Table 3 in the order of the time taken t to rot, and Fig. 2 shows the breaking st curves, relating to the number of days the treated with preservatives were subje continuous immersion.

Table 3. Percentage breaking strength relating to the number of days immersed.

Preservative	Persentage breaking strength							
	Time in Days:							
	On treatment	7	12	17	20	27	35	43
Control (untreated)	100	41.0	8	0.0	0	—	—	—
Myrobalan nuts	119	1.5	0	—	—	—	—	—
Product B	103	17.3	6	0.0	—	—	—	—
Bark of "Kalasam"	114	70.0	10	0.0	—	—	—	—
"Panichikka"	120	117.0	13	2.0	0	—	—	—
Product A : Kerosene 1:6	107	42.5	14	8.6	0	—	—	—
Product A : Kerosene 1:4	126	80.0	25	4.3	0	—	—	—
Product A : Kerosene 1:2	120	63.6	19	11.1	0	—	—	—
Coal tar: Kerosene 3:1	104	63.6	50	56.0	49	41	42	23.4
Product. A : Coal tar	105	120.0	106	101.0	83	58	33	40.0
Bark of "Kalasam" plus coal tar	121	101.0	108	114.0	114	114	Lost	from

Temperature of Backwaters:

The temperature of backwaters where the sample twines were subjected to continuous immersion tests, was taken thrice a day at 0900, 1300 and 1700 hr. The average during No was 31.1°C, while the average room temp was 28.4°C. During December, the temperature of backwaters and room 29.8°C and 27.7°C respectively.

Table 4. Room and backwater temperature.

Period	Room temperature in °C			Backwater temperature		
	Average	Maximum	Minimum	Average	Maximum	M
November '57						
First fortnight (from 6.11.57 to 15.11.57)	28.4	30.0	27.0	31.1	33.0	
Second fortnight (from 16.11.57 to 30.11.57)	28.4	30.0	26.0	31.1	33.5	
December '57						
First fortnight (from 3.12.57 to 15.12.57)	28.0	30.0	25.0	30.8	32.5	
Second fortnight (from 16.12.57 to 28.12.57)	37.8	31.0	25.0	28.8	30.0	

DISCUSSION

As shown in Table 2, and Fig. 1, it seems yrobalan nuts and Product B are both as net preservatives. Bark of "Kalasam" oduct A with kerosene in different ratios o have some effect on preservation. Coal ed with kerosene, and product A plus r showed good results. The few obser- made on the sample treated with bark oal tar, before it was lost, indicated ely good effects of this treatment.

The process of rotting has two courses, B as shown in Fig. 2. In the case of A, ing occurs and proceeds as a straight line to b and curves from b to c. On the and, in the case of B, the rotting does not until the point b is reached whence it ds as in the case of A.

Control, myrobalan nuts, product B, bark roduct A seem to belong to A and ikka, bark plus coal tar, and product A al tar seem to belong to B.

In the case of A, we can infer the effec- s of preservative by comparing the ess of the lines from a to b. The parts to c have almost lost their original g strength and serve no purpose for the nents.

l (untreated): $T_n = 16.2 - 1.35\,n$

ut: $T_n = 19.3 - 2.80\,n$

t B: $T_n = 16.7 - 1.58\,n$

f "Kalasam": $T_n = 18.4 - 1.23\,n$

t A plus kerosene (1:6) $T_n = 17.4 - 1.34\,n$

t A plus kerosene (1:4) $T_n = 20.4 - 1.23\,n$

t A plus kerosene (1:2) $T_n = 19.4 - 1.32\,n$

Figures 3 (a and b) show the relation n breaking strength and the number s the twine was immersed in backwaters, e line in each diagram expresses the e breaking strength for the number of mmersed.

Now, let **To** denote the original breaking strength, i.e., breaking strength in wet condition after treatment and **Tn** the breaking strength in wet condition after the twine was immersed in water for n days.

Then, we get the following formula

$$T_n = T_o - kn \quad \ldots\ldots \quad (1)$$

where **k** is the co-efficient of rotting and the value of **k** depends upon the oceanographical conditions, material of twine and effectiveness of net preservative. In this case, the factor **k** may depend on net preservative only, as the same twine was used in the continuous immersion tests in the same area of the backwaters. The effectiveness of the preservative can be compared then by a comparison of the value of **k** in each case.

The value of **To** is given in Table I and the formula (1) for each preservative runs given below. Here **To** and **Tn** are represented in lb. and therefore the value of **k**, shows the decrease in breaking strength in lb. per immersion day.

Comparing the values of **k** we can express the effectiveness of each preservative, as follows:

1. Twines treated with myrobalan nut and product B rotted quicker than the control (untreated).
2. Product A was also not very effective. But it seemed effective as per Fig. 1; this was due to an increase in the original breaking strength after treatment. Product A with kerosene in ratios 1:6, 1:4 and 1:2 had almost the same preserving effect.
3. Bark of "Kalasam" had little preserving effect.

In the case of B, we can formulate the process of breaking strength as follows:

$T_n = T_o - k(n - N)$ ..... (2) where $n < N$.

Here N represents the number of days for which period the twine did not rot and kept its original breaking strength. It is obvious that the value of N is constant for each preservative if the environmental conditions, material of twine and the manner for use are not changed.

Then, we obtain the following experimental formulae from Fig. 3 (a and b):

"Panichikka" $T_n = 19.4 - 3.4\ (n-7)$

Product A plus coal tar $T_n = 17.1 - 0.57\ (n-14)$

The purpose of using net preservative is only to prolong the period of N, for if once there is decrease in the breaking strength, we could never regain the original strength. N may be called "Number of effective days of the preservation."

On this basis, Product A plus Coal Tar showed good results having about 14 effective days of preservation and it was estimated that the bark of "Kalasam" plus coal tar was the best among all preservatives in this series.

Coal tar took a course differen those for all other preservatives as sh Fig. 3, i.e., nearly half the breaking s was lost by the first 7 days and after t strength was decreasing gradually.

SUMMARY

Fishing gear preservation is an im subject under fishing gear technolog original work appears to have been carr in India on gear preservation and in th series of experiments at the Fisheries T logical Research Station, a study of six pr tives subjected to continuous immers backwaters, was made.

From the results obtained, it is in that myrobalan nuts and Product B are tive; Product A; bark of "Kalasam" and chikka" not very effective; while Coal ta duct A plus coal tar, and bark of "K plus coal tar are effective, especially B "Kalasam" plus coal tar which seemed t excellent effects, though lost durin midst of the experiments.

SERIES 2: COMMERCIAL PRODUCTS AND LOCAL PRESERVATIVES WITH COAL TA

MATERIALS AND METHODS

Twines Tested:

The twines tested had the following specifications:

1. Material: Russian cotton twine, No. 32, 18 threads, 3 ply and soft twisted.
2. Number of twist: Outer twist (clockwise) 100: inner twist 80 per foot.
3. Weight: 0.565 g. per metre.
4. Thickness (diameter) *: 1.03 mm.
5. Breaking strength in lb.:

	In dry condition	In wet condition **
Average	16.30	19.28
Maximum	18.20	20.80
Minimum	14.40	17.80

6. $\dfrac{\text{Breaking strength in wet condition}}{\text{Breaking strength in dry condition}} = 1.18$

* Average of 12 tests.

** Twines immersed in fresh water for about 24 hours.

One bundle of fifty pieces of cotton
of the above specifications, weighing
and about 54 inches in length each was
with each of the preservatives in this

ratives Experimented:

Five commercial brands and three local
atives with coal tar were experimented
series. The treatment of these preserva-
s applied in this series of experiments, is
ed below separately.

1. **Product A: Kerosene = 1.3.** Fifty cc.
luct A were well stirred with 150 cc. of
ne in a metal container. The cotton
undle was immersed in the green solution
d and turned over well for about 5 mi-
After draining off the excess solution, the
were hung freely and dried in shade in a
ntilated room for about five days. The
were green in colour, soft and pliable.

2. **Bark of "Kalasam"** *(Odina wodier)*
oduct A: The twines treated in bark of
am" and dried as in item 9 of series 1
nents, were dipped in a solution of 67 cc.
luct A and 133 cc. of kerosene, pressed
ned over well for about 5 minutes. After
g the excess solution, the twines were
reely and dried in shade in a well ven-
room for about five days. The treated
were very dark green in colour with a
tinge at certain spots, soft and pliable.

3. **Myrobalan nuts (*Terminalia* species)**
al tar: One bundle of twine was first
with the nuts and dried as in item 7 of
. These were dipped in a bath of 50 cc.
sene and 150 cc. of coal tar, pressed and
over well for about 10 minutes. The
solution was drained and then the twines
ung separately and dried in a well ven-
room for about five days. The treated
were black in colour and fairly stiff.

4. **"Panichikka"** *(Diospyros embryop-*
and coal tar: "Panichikka" extract
200 cc. were taken from a big mud pot in
the crushed "Panichikka" were kept in
for about a fortnight and the bundle of
immersed, turned over well and kept
pressed for about 24 hours. The stiff, purple coloured twines so obtained were later dipped in a bath of 3 parts of coal tar and one part of kerosene, *i.e.*, 150 cc. of coal tar and 50 cc. of kerosene, pressed and turned over well for about 10 minutes. The twines were hung separately in a well ventilated room and dried for about five days. The treated twines were black in colour and stiff.

5. **Product C (a variant of product A, darkish green in colour):** Two hundred of this product were taken in a metal container and the bundle of twines pressed and turned over well for about a dozen times. The dark green twines so treated were spread freely in a well ventilated room after draining the excess preservative and dried for about five days. The twines were stiff.

6. **Product D (another variant of product A, black in colour):** The twines were dipped and pressed in 200 cc. of the preservative for about 5 minutes, and then spread freely in shade and dried for about five days. The treated twines were light black in colour, soft and pliable.

7. **Product E (a third variant of product A, green in colour):** The twine similarly treated in this preservative and dried as in items 5 and 6 above was slightly bluish green in colour and stiff.

8. **Product F (made by same firm that produced product A, brownish black in colour):** Twines similarly treated in this preservative dried and as in items 5 and 6 above was dark brown in colour, soft and pliable.

RESULTS

Impregnation of Preservatives in the Twines:

The impregnation of the various preservatives into the twines tested is given in Table 5.

Breaking Strength Tests of Twines Experimented:

The twines of each bundle treated and dried were separately hung in iron frames on 13.11 57 from the bamboo raft anchored in Cochin backwaters. The surface water temperature of the backwaters during the experiment was taken as in Series 1 :

Table 5. Percentage impregnation of preservatives into the cotton twines.

	Preservative	Weight in g. of dry bundle of twines after treatment	Difference in weight (in g.) before and after treatment	Percentage impregnation of the preservative
1.	Product A: kerosene (1:3)	71.605	23.605	49.17
2.	Myrobalan nuts and coal tar	115.960	67.960	141.58
3.	"Panichikka" and coal tar	102.815	54.815	114.19
4.	"Kalasam" bark and Product A	91.350	43.850	90.31
5.	Product C	77.155	29.155	60.73
6.	Product D	69.110	21.110	43.97
7.	Product E	74.550	26.550	55.31
8.	Product F	62.975	14.975	31.19

Breaking Strength Tests of Twines Experimented:

The twines of each bundle treated and dried were separately hung in iron frames on 13.11.57 from the bamboo raft anchored in backwaters. The surface water temp of the backwaters during the experime taken as in Series 1:

Table 6. Water temperature during the experiments.

Period	Backwaters temperature in °C		
	Average	Maximum	Minimum
6.11.57 to 30.11.57	31.1	30.0	26.0
3.12.57 to 28.12.57	29.8	31.0	25.0
2.1.58 to 16.1.58	28.6	30.0	27.0

Three pieces of twines from each frame were removed at different periods and tested for their breaking strength in wet condition. The average breaking strength was taken from nine tests in each case and furnished in Table 1. The bamboo raft used in this experiment is already described in Appendix II of Series 1.

Percentage Breaking Strength of Twines Experimented:

Table 6 and Fig. 4 (a & b) give the percentage breaking strength of twines tested after different periods of continuous immersion in backwaters. It will be observed from these that though Products A, C, D, E, and bark of "Kalasam" plus product A increased by 10 to 15% the breaking strength of the after treatment, tannin preservatives pl tar, and product F decreased the original s of the twines by about 10%. Twines with products A, D and F were found quickly; those treated with products C showed a little better results. B "Kalasam" plus coal tar, and myroba plus coal tar were found to have a fair effect on the twines. Though the test treated with "Panichikka" plus coal t lost, during the experiment, primary tions indicate this combination to be effective.

Table 7. Relation between breaking strengths and the length of immersion

ervative used;	Breaking strength in lb. Time in Days											
	On treatment	5	7	11	14	21	24	28	36	43	50	57	64
ol (Untreated)													
Aver.	19.28	7.17			0.66	Rotten							
Maxi.	20.80	8.75			2.00								
Mini.	17.80	5.75			0.00								
uct A: kerosene (1:3)													
Aver.	21.30	13.96			4.50		0.60	Rotten					
Maxi.	25.00	17.50			9.00		2.00						
Mini.	18.25	10.25			0.00		0.00						
nut plus coal tar													
Aver.	17.55	16.63			14.60		11.90		10.90	11.00	8.6	3.9	Rotten
Maxi.	19.75	18.00			17.80		18.00		17.80	17.20	17.0	11.0	
Mini.	15.00	15.50			12.60		6.80		4.00	2.80	3.5	0.0	
nichikka" plus coal tar													
Aver.	17.23	16.26			17.00		16.80		18.10	18.8	16.0	17.7	14.3 Lost
Maxi.	19.50	17.00			18.60		19.50		19.20	20.5	17.5	19.2	17.5
Mini.	16.00	15.50			12.50		12.20		17.00	17.8	11.5	16.0	9.2
of "Kalasam" plus Product A													
Aver.	22.31	19.50			18.10		15.00		14.70	11.0	12.3	10.5	5.9 Rotten
Maxi.	24.50	21.25			19.80		17.00		17.50	16.0	16.0	15.0	9.8
Mini.	19.75	17.25			15.00		12.20		7.80	0.5	6.0	2.6	2.2
uct C													
Aver.	20.28	19.60			10.90		8.60		4.80	1.4 Rotten			
Maxi.	23.50	21.60			13.50		11.20		7.60	4.8			
Mini.	19.00	17.00			7.00		5.00		2.80	0.0			
uct D													
Aver.	18.15	14.75			5.04		2.70	2.1 Rotten					
Maxi.	29.00	16.25			8.00		4.80	5.0					
Mini.	16.75	12.50			3.20		1.00	0.2					
uct E													
Aver.	21.88	17.55			12.50		8.20		2.80	0.9 Rotten			
Maxi.	23.80	19.50			13.80		10.80		7.80	4.0			
Mini.	19.75	16.40			10.20		5.50		0.00	0.0			
uct F													
Aver.	16.74	11.84			2.60		1.73 Rotten						
Maxi.	17.60	14.25			4.00		4.00						
Mini.	15.75	10.50			1.50		1.00						

Table 8. Percentage breaking strength at different periods of immersion

	On treatment	7 Days	14 Days	21 Days	24 Days	28 Days	36 Days	43 Days	50 Days	57 Days	D
Control	100		0.00	-	-						
Product A : kerosene (1 : 3)	111	73	23.30	3.10	Rotten	-	-				
Gall nut plus Coal tar	91	86	76.00	62.00		56.5	57.2	45	20.2	Rotten	
" Panichikka " plus Coal tar	89	84.5	88.30	87.00		93.8	97.5	83	92.0	74.1	
Bark of " Kalasam " plus Product A	115	101	94.00	79.00		76.4	57.2	64	54.5	30.5	
Product C	105	102	56.70	45.00		24.8	7.3	Rotten			
Product D	94	76.5	26.20	14.00	11.0		Rotten				
Product E	114	91.0	65.00	43.00		14.5	4.7	Rotten			
Product F	87	61.5	13.50	9.00	Rotten						

DISCUSSION

The value of T_n ($T_n = T_o - Kn$) * for each preservative runs as follows :

Control :	$T_n = 19.3 - 1.90\ n$
Product A plus kerosene 1 : 3	$T_n = 21.3 - 1.13\ n$
Product F	$T_n = 16.7 - 0.89\ n$
Product D	$T_n = 18.2 - 0.67\ n$
Product E	$T_n = 21.9 - 0.67\ n$
Product C	$T_n = 20.3 - 0.51\ n$
Bark plus product A	$T_n = 22.2 - 0.27\ n$ ($n < 50$ days)
Myrobalan nuts plus coal tar	$T_n = 17.6 - 0.23\ n$ ($n < 40$ days)

Here T_o and T_n are given in lb. and therefore the value of K shows the decrease in breaking strength in lb. per day of immersion in backwaters. The value of K is calculated from Fig. 2.

Comparing the values of K, the effectiveness of each preservative can be expressed as follows:

1. Product A was not very effective as was already observed in the first series of the experiments.
2. Product F was also not very effetivec.
3. Product C, D and E were equall effective.
4. Bark of "Kalasam" plus prod and myrobalan nuts plus coal ta very effective.
5. Though the frame from whic sample twine of "Panichikka" coal tar was hung was lost fro raft, the twines were not fou lose their original breaking st for about 50 days, i.e., this pre tive was showing the best effe all the preservatives.

* These notations have the same meanings as for the experiments in Series I. (See p. 8, last and p. 9, first para).

SUMMARY

A study of all the eight preservatives *i.e.*, it plus coal tar, "Panichikka" plus coal rk of "Kalasam" plus coal tar, and 5 rcial preservative solutions was made in cond series of net preservation experi- *The twine treated with "Panichikka" and did not lose their original breaking strength ffness even after about 50 days of continuous ion in backwaters.* Bark of "Kalasam" roduct A, and myrobalan nuts plus coal re also found effective ranking next to hikka" plus coal tar, and the fall in g strength in these cases was very l, the twine having rotten after about 60 f continuous immersion in the backwaters. These preservatives may be considered as the best of all tested so far. They will prove very effective in India for trawls and stake nets which are subjected to a continuous use during a season.

ACKNOWLEDGEMENTS

Our thanks are due to Sri A. Raman M.A., Professor of Botany, Maharajah's College, Ernakulam, for identifying the locally available vegetable net preservation materials.

We are thankful to Sri V.T. George, B.Sc., Superintendent, Fishermen Training Centre, Ernakulam and his staff for assisting us in the construction of equipment designed for the above experiments.

APPENDIX I
SOME NET PRESERVATIVES AND METHODS FOR THEIR APPLICATION

MYROBALAN NUTS *('Kadukka' in Malayalam)*

These are dried fruits of two species of Indian trees *Terminalia chabula* and *Terminalia bellaroria*. The nuts have a tannin content of 30 to 40%. The trees grow widely in India. The dried fruits are dark brown in colour and spindle shaped, about an inch long and about ½" in diameter.

Directions for use : The seeds are removed from the dried fruits and the shells are crushed to powder and boiled with water in a metal container till a concentrated solution is obtained. The webbings are turned well in the filtered solution and then kept pressed in it for about 24 hours. The webbings are later taken out and hung freely for drying. Usually, new nets are redyed after drying for 24 hours or so.

Drying : The treated webbings may be dried in sun or shade.

Storing : For long term storage, the nets are thoroughly washed, dried and piled in a dry shady place or hung in a ventilated place.

"PANICHIKKA"

"Panichikka" is the malayalam name of the fruits from the tree "*Diospyros embryopteris*" (Family: Ebenallae) growing widely in Kerala State. The average age of the tree is ten years and it fruits for about 3 to 4 months a year from October to January. The fresh unripe fruits, light green in color, are almost spherical in shape, about 2" to 3" in diameter.

Directions for use : The fresh unripe fruits are crushed well to a paste and kept for 2 to 3 days in an earthen pot containing sufficient cold water to cover the paste. The thick purple colored sticky liquid obtained, is a good preservative for cotton lines. The lines are kept immersed in the filtered liquid for a day or two, then taken out and dried.

Drying : The treated lines are dried in the sun for a day or two. Usually the lines are redyed twice, stretched well and rubbed hard with the crushed paste till the lines get a uniform, smooth coating of it. The lines so treated are black in color and very stiff.

Storing : The lines are well washed, dried and hung in small coils.

BARK OF "KALASAM" *(In Malayalam)*

The "Kalasam" tree of the species *wodier* (Family: Anacardiaceae) grows in India and the brackish brown bark about 3 mm. thick is widely used by fishermen tanning their nets. Good thick bark obtained from trees about ten years old.

Directions for use: The well dried are cut to small pieces, crushed well and with water in a metal container till a concentrated blackish red extract is obtained. extract is then filtered. More extract remains in the hot crushed bark is also pressed out collected. The webbings to be treated are mersed in this extract, turned well and pressed in it for about 24 hours. They are taken out and dried.

Drying: May be in shade or sun. new nets are usually redyed once more use. The dyed nets in use are dyed once fortnight or at least once a month.

Storing: The nets after being well and dried are hung in shade.

COAL TAR

Coal tar is primarily used for heavy like trawls where abrasion is an important in the deterioration.

Specifications of coal tar recommended for

Bitumen:	88%
Water:	Not more than
Specific gravity:	1.10 at 25°C
Specific viscosity:	18 to 25 at 40°

Directions for use: Usually the web previously cleaned and dried well are d and pressed for about 3 minutes in co heated to about 150°F in a metal cont While heating the tar should be cons stirred to prevent over-heating and charr the webbing. The webbings are then p through a wringer to remove the excess ta

Various modifications of the co treatment have been developed. 4½ g. of Be and 5½ g. of coal tar for each 15 lb. of c oleate or naphthenate is a good mixture

ıe advantage of giving satifactory penetra-
ivithout heating; besides, this decides the
ıg time.

Drying: Direct sun-shine rots the tarred
Drying of tarred nets is best done by
ng them in a shady place with free air
ation.

Storage: When freshly tarred, nets should never be heaped. After use, if heaping is necessary, small quantities of coarse salt should be sprinkled on every layer of the heap. Tarred nets are best stored by hanging them in a well ventilated sheltered place.

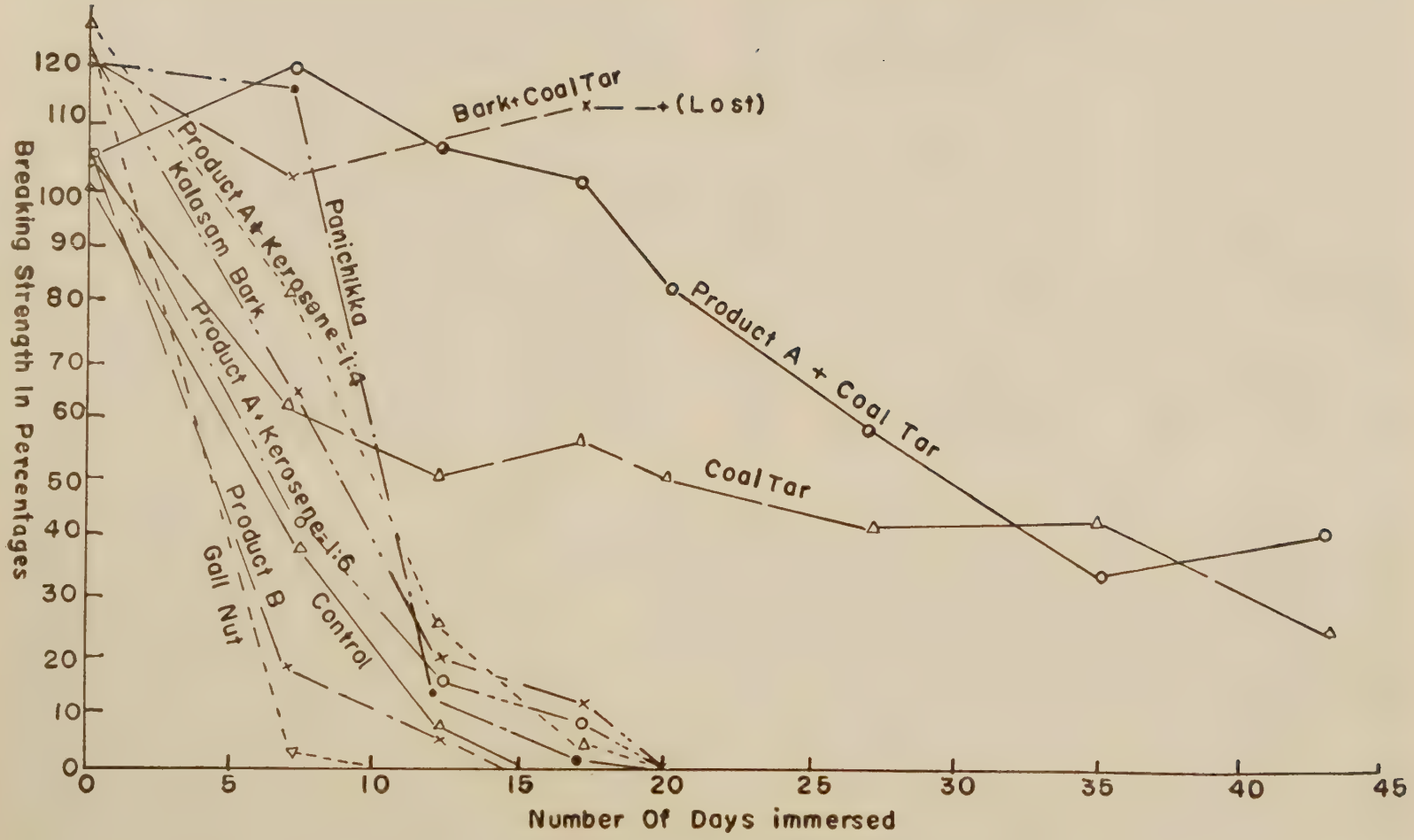


Fig.1

Relation between breaking strength of twines and the number of days immersed in the backwater. Breaking strengths are shown in percentages taking the breaking strength of the Control in wet condition as 100

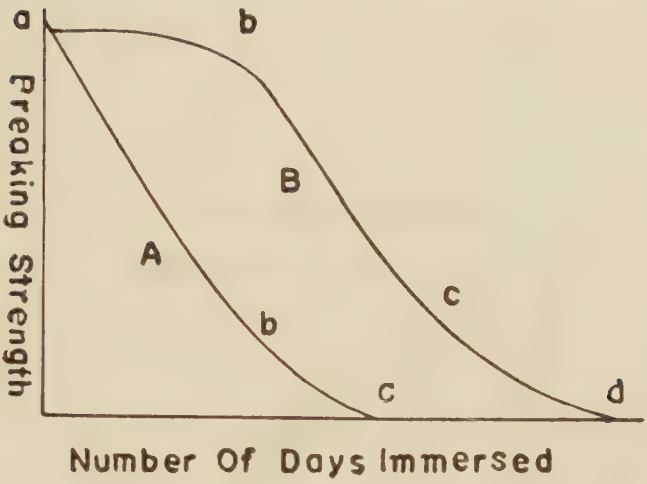


Fig. 2. Showing the two typical courses of rotting of twines immersed in the backwaters.

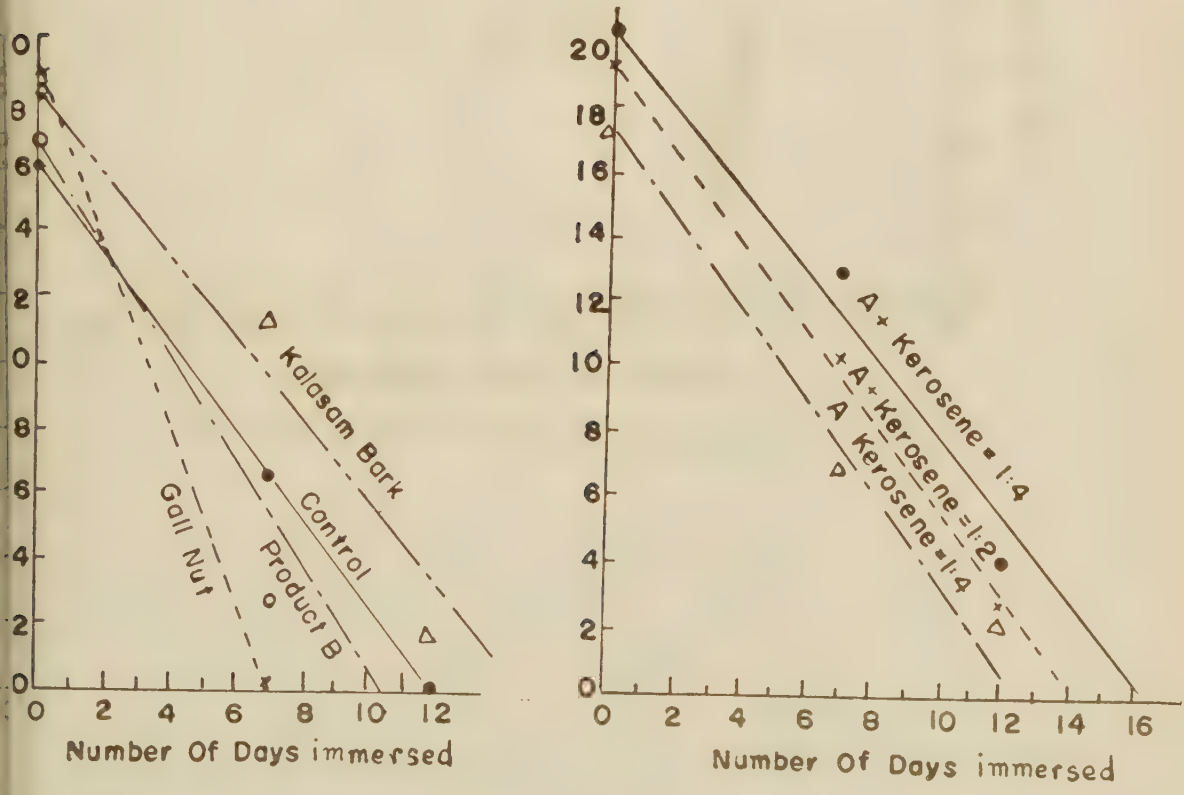


Fig 3

(a). Relation between average breaking strength and the number of days immersed.

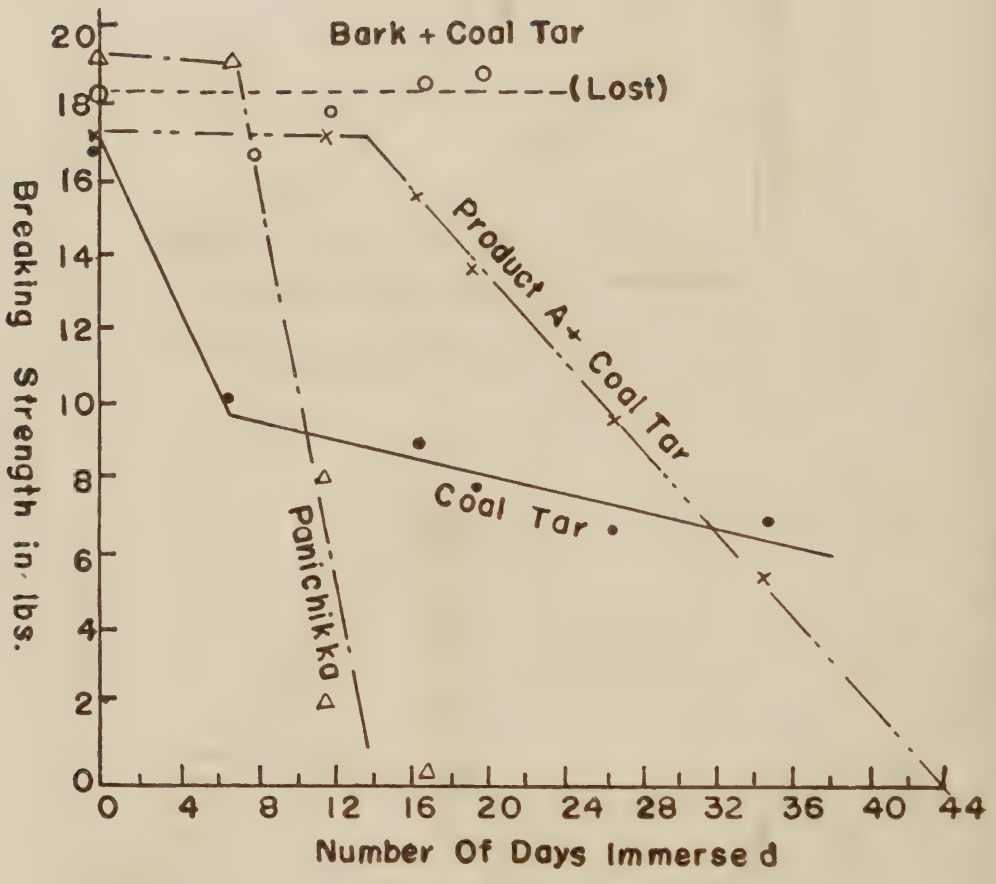


Fig. 3. (b). Relation between average breaking strength and the number of days immersed.

Fig. 4 (a)

Relation between average breaking strength and length of immersion in backwaters.

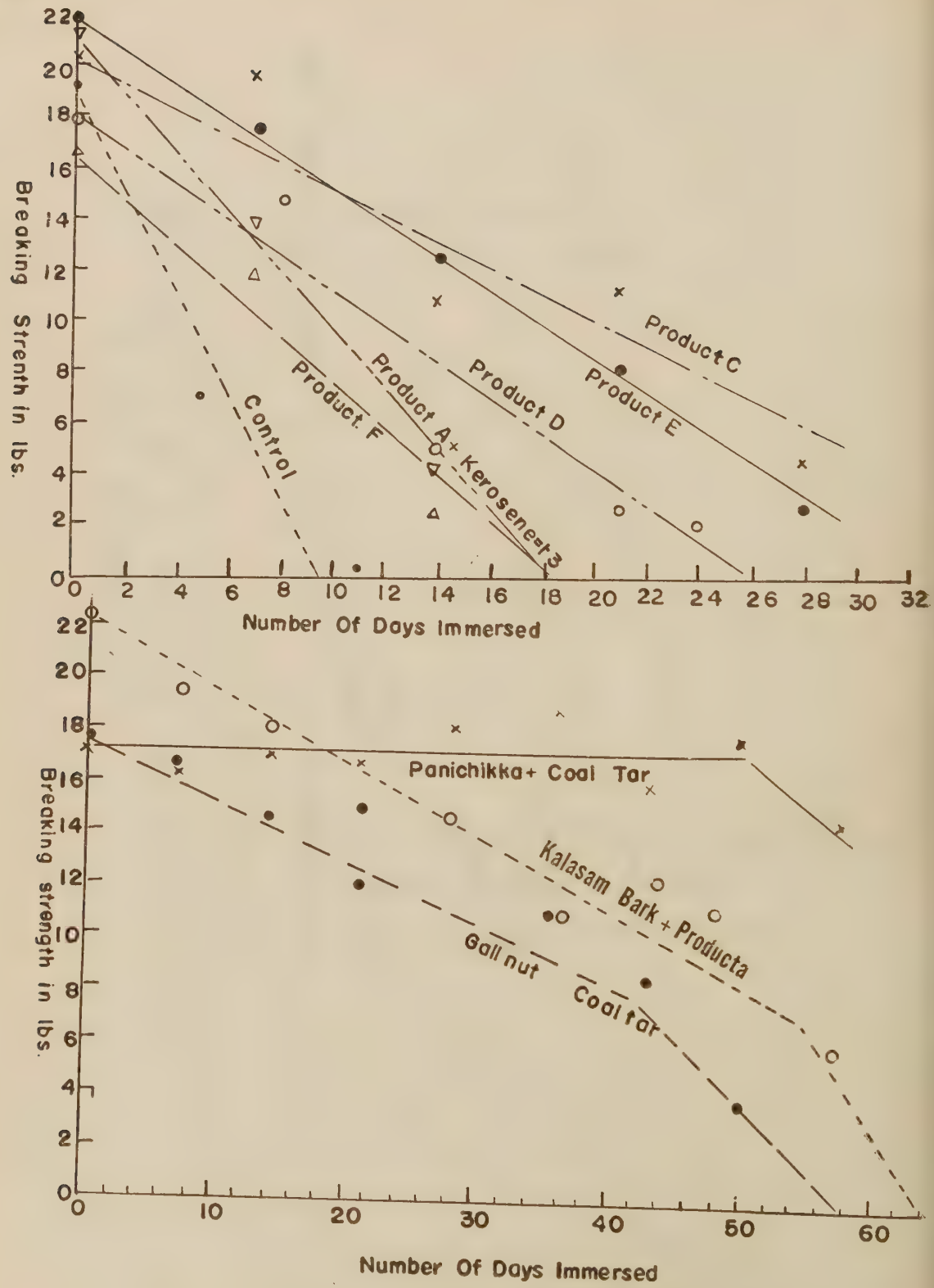
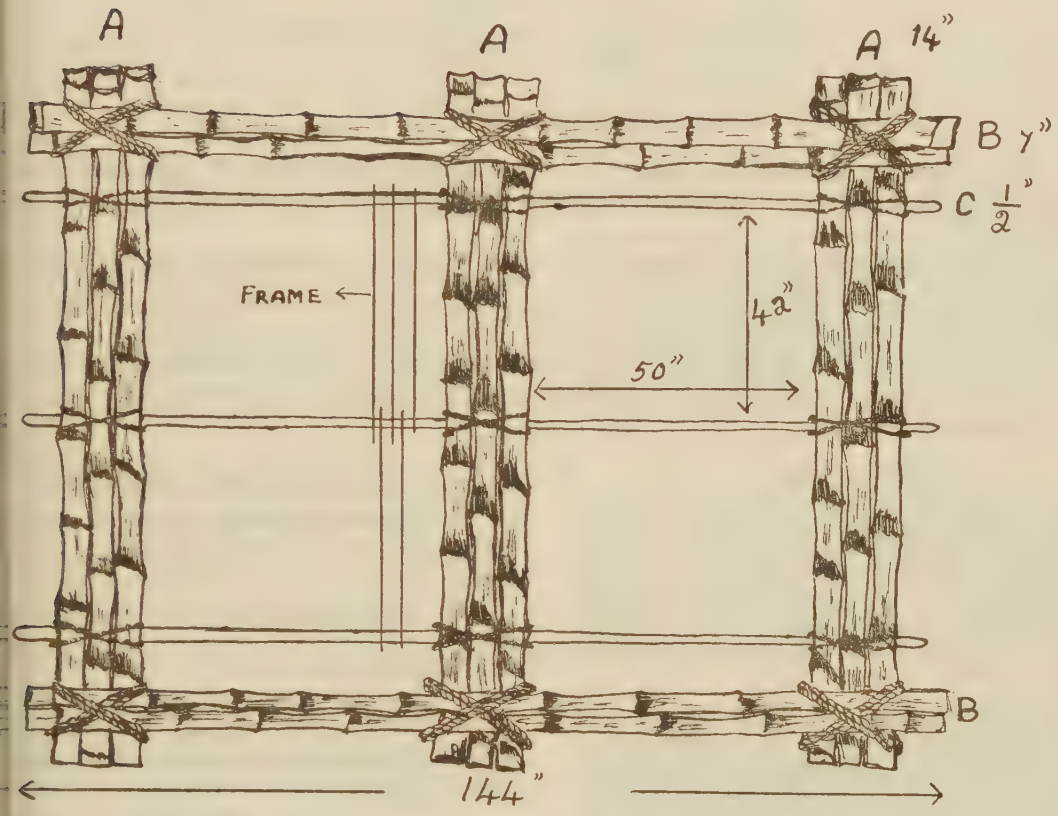


Fig. 4. (b). Relation between average breaking strength and length of immersion in backwaters.

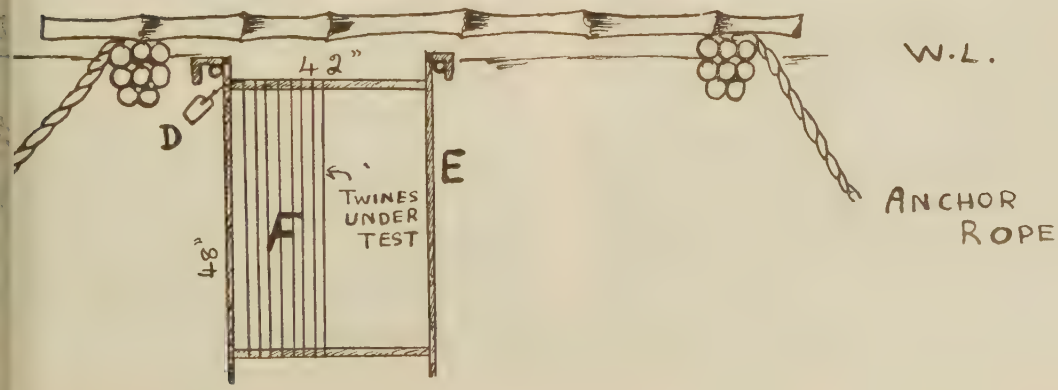
APPENDIX II

A: 8 bamboos; B: 4 bamboos
C: Iron rod; D: Tag
E: Iron frame; F: Twines under test

BAMBOO RAFT



VIEW OF FRAME HANGING IN THE RAFT



STUDIES ON THE PROCESSING AND STORAGE OF DRIED SPLIT-SALTED *BISUGO (NEMIPTERUS* SPP.)

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ABSTRACT

The standard method of preparing dried split-salted 'bisugo' (*Nemipterus* sp may be considered as the representative method for all dried split-salted fishery produ 'daeng'.

The scaled, split and eviscerated fish were cured in concentrated brine for not l than 12 hours, soaked in fresh water for 0 to 120 minutes and then dried in the sun 16 hours. The sodium chloride content ranges from 27.41 to 17.44 per cent.

For keeping qualities moisture-proof cellophane bags were found effective. Treat the dried fish with one percent solution of antimold Sorbistat K, the storage quality greatly improved.

INTRODUCTION

The manufacture of dried salted fishery products is an old and flourishing industry in the Philippines but for lack of standard methods of preparation, the appearance, presentation, taste and storage qualities of the products have yet to be improved.

In the belief that heavy salting would prolong the keeping quality of salted fishery products, the present tendency is to oversalt them with the result that they are too salty and susceptible to the attack of molds due to the hygroscopic nature of solar salt impurities, especially magnesium chloride (Hamm, 1949 and Lafont, 1952.)

The salt compound of sorbic acid, Sorbistat K, (CH_3 CH=CHCH=CHCOOK)* which is commonly used as an anti-mold agent was used in this study.

The study on the processing and storage of dried split-salted 'bisugo' (*Nemipterus* spp.) was conducted to standardize the method of its manufacture so that standard quality products may be prepared for both local and export trades.

EXPERIMENTAL METHODS

To determine the effects of refine solar salt in the manufacture of dried split fishery product, two kinds of concer brines were prepared and the scaled and eviscerated fish were soaked in th not less than 12 hours.

Soaking in fresh water. The brinesalted fish were soaked in equal a of fresh water according to the following vals of time:

1. 0 minutes
2. 30 ,,
3. 60 ,,
4. 90 ,,
5. 120 ,,

The fish were the dried in the sun hours and set aside for observation and k qualities.

Chemical analysis. As soon as dri experimental products were chemically a for moisture, sodium chloride, and fat co

Storage studies. To determine th molding quality of Sorbistat K on the fishery product, experiments were unde and the fish were treated & stored as foll

* Sorbistat K is a product of the Pfizer International, Inc. New York, N.Y., U.S.A.

SOLAR SALT

Control (not treated with Sorbistat K)	B. Treated with Sorbistat K
Washed but not soaked in fresh water:	
a. Exposed - - - - -	(a) Exposed
b. Sealed - - - - -	(b) Sealed
Soaked for 30 minutes in fresh water:	
c. Exposed - - - - -	(c) Exposed
d. Sealed - - - - -	(d) Sealed
Soaked for 60 minutes in fresh water:	
e. Exposed - - - - -	(e) Exposed
f. Sealed - - - - -	(f) Sealed
Soaked for 90 minutes in fresh water:	
g. Exposed - - - - -	(g) Exposed
h. Sealed - - - - -	(h) Sealed
Soaked for 120 minutes in fresh water:	
i. Exposed - - - - -	(i) Exposed
j. Sealed - - - - -	(j) Sealed

Experiments on the storage of dried fishery products using refined salt with thout Sorbistat K were conducted in the manner as with solar salt.

RESULTS AND DISCUSSION

Drying. To avoid abrupt drying, the fish were turned over every two hours so ying may be accomplished evenly.

Fatty fish when dried abruptly in the hot rmed a paint-like coating in the surface events inner drying (Empey, 1953).

The fish were dried completely in the hot 16 hours (Fig. 1).

Color. Immediately after drying, the color product is golden brown and the shade es lighter according to the length of g in fresh water, that is, the longer the fish were soaked in fresh water, the is the color of the dried product.

Tanikawa (1951), Sulit *et al* (1957), 1949) and Luypen *et al* (1953) claimed pon storage, the color of dried salted product becomes darker in the shade lly in tropical countries when the hot r months hasten darkening of the color. led that in many cases when the moisture t is high, unpleasant odor is developed e rate of spoilage increases as the temperature rises. Dried fish packed in cans and stored at 25°C remained in good condition from 6-9 months.

In this study, it was very significant that the original color of the salted fish is retained effectively when packed in hermetically sealed containers. The product which had been stored for more than four months still retained the original golden brown color, but those exposed in the atmosphere without packing in hermetically sealed containers, developed darkening in color.

Hygroscopic action of salt. Upon storage, the dried salted fish that were soaked from 0-30 minutes in fresh water accumulated moisture on the surface, and those that were soaked from 90-120 minutes remained thoroughly dry. It is claimed that during the soaking period of the cured fish in fresh water, salt impurities were eliminated together with the sodium chloride, as also magnesium chloride which is more soluble than sodium chloride.

It is quite advantageous to wash the cured fish with fresh water because only part of the pure sodium chloride remained in the dried salted fish and the impurities are completely removed therefrom. In this connection, the use of solar salt with high impurities would not affect materially the quality of the finished product.

Salt content. Chemical analysis of the salted dried fishery product is shown in Table 3. It is very significant that those that were not soaked in fresh water contain high amount of sodium chloride, 27.41. per cent, and the percentages of salt are lessened according to the length of time of soaking in fresh water. The amount of salt went down as low as 17.44 per cent in those cured fish soaked for as long as 120 minutes.

Action of Sorbistat K. Sorbistat K, an anhydrous water soluble potassium salt of sorbic acid ($CH_3CH = CHCH = CHCOOK$) has been known to prolong the shelf-life of various salted and smoked fishery products.

In this study, those that were treated with 0.5 to 1 per cent Sorbistat solution did not develop mold even after four months storage. Even those that were kept exposed without putting in hermetically sealed containers are not yet moldy up to the present time. The

control without Sorbistat began to get moldy within one month's time of storage, and those that were sealed in hermetically sealed containers developed molding at the beginning of the third month of storage. It is very significant that those with higher percentage of salt (Table 3) are the ones that developed early molding.

SUMMARY AND CONCLUSION

With the aim of standardizing the method of preparing dried split-salted fishery product, a standard species of fish (Nemipterus spp.) was used in the experiment.

The dressed fish were soaked in two kinds of concentrated brine solutions prepared from the crude solar and refined salts, and cured for not less than twelve hours. After brining, the cured fish were soaked in fresh water at various intervals of time to remove partially the salt and then dried in the sun for at least sixteen hours (Table 2).

The dried salted fish were packed accordingly and set aside for studies on the storage qualities.

The cured fish soaked in fresh water from 90-120 minutes are considered ideal from the standpoint of physical appearance, taste and storage qualities, and the amount of salt ranges from 18.86 to 17.44 per cent.

Sorbistat K, a potassium salt of sorbic acid ($CH_3CH = CHCH = CHCOOK$) at a concentration of 0.5 to 1 per cent was found to be very effective as anti-mold in the salted fishery product; those stored in hermetically sealed containers for a period of more than four months did not develop any mold at all.

At present, Sorbistat K is being experimented with whole dried salted fishery products and the results obtained are similar with dried split-salted *bisugo (daeng)*.

Those that were soaked in fresh water from 90-120 minutes have ideal appearance and salty taste and keep much longer than those with higher percentage of salt.

The average yield of dried split-bisugo is 50.95 per cent when cured pure salt and 47.54 per cent with sola (Table 2).

In the light of the aforementioned and findings, it is quite safe to recomm cure the fish in concentrated brine of pure or solar salt, and dry in the sun f less than sixteen (16) hours.

The soaking time to remove amount of salt in cured fish is 90 to 120 m which results in the production of st salted fishery products containing 18.86 t per cent salt.

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Weight of whole fish (3 pieces)	Weight of dried fish		Length of soaking in fresh water	Weight of cured fish after soaking in fresh water		Yield	
grams	grams	Per cent	Minutes	grams	Per cent	grams	Per cent
Treated with pure salt:							
1. 503.0	430.5	85.59	0	390.4	77.61	272.5	54.17
2. 453.0	396.8	87.59	30	365.6	80.71	230.5	50.88
3. 367.2	307.4	83.71	60	304.2	82.84	175.5	47.80
4. 519.3	472.9	91.06	90	446.9	86.06	272.9	52.55
5. 363.3	325.4	89.57	120	321.8	88.58	179.3	49.35
Treated with solar salt:							
1. 364.5	318.2	87.30	0	275.5	75.58	182.2	49.99
2. 330.5	311.9	94.37	30	279.3	84.51	166.5	50.38
3. 413.1	364.9	88.33	60	335.8	81.29	196.8	47.64
4. 310.4	269.1	86.69	90	264.6	85.24	148.6	47.87
5. 323.9	279.3	86.23	120	273.5	84.44	135.4	41.80

Table 2. Periodical weight of cured split salted *bisugo* (Nemipterus spp) while in the process of drying.

Weight of fish in whole	Length of soaking in fresh water	Weight of cured fish while in the process of drying							
		7.30 A.M. — 11.30		12.00 — 4.00		7.30 A.M. — 11.30		12.00 — 4.00	
grams	Minutes	grams	Per cent	grams	Per cent	grams	Per cent	grams	Per cent
Treated with pure salt:									
1. 503.0	0	394.80	78.49	312.51	62.13	278.11	55.29	272.5	54.17
2. 453.0	30	349.26	77.10	280.31	61.88	245.80	54.26	230.5	50.88
3. 367.2	60	282.89	77.04	220.39	60.02	195.20	53.16	175.5	47.79
4. 519.3	90	401.05	77.23	331.78	63.89	284.52	54.79	272.9	52.55
5. 363.3	120	284.10	78.20	221.57	60.99	192.62	53.02	179.3	49.35
Average			77.61		61.78		54.10		50.95
Treated with solar salt:									
1. 364.5	0	288.89	79.12	219.75	60.29	197.89	54.29	182.2	49.99
2. 330.5	30	260.03	78.68	198.03	59.92	178.21	53.92	166.5	50.38
3. 413.1	60	320.06	77.48	259.55	62.83	225.68	54.63	196.8	47.64
4. 310.4	90	239.50	77.16	189.09	60.92	167.24	53.88	148.6	47.89
5. 323.9	120	249.27	76.96	197.77	61.06	175.42	54.16	135.4	41.80
Average - - - -			77.88		61.00		54.18		47.54

ble 3. Chemical analysis of dried split-salted *bisugo* (Nemipterus spp.) soaked at various intervals in fresh water.

Time of soaking in fresh water	Moisture	Fat	Sodium chloride
Minutes	Per cent	Per cent	Per cent
0	36.99	1.09	27.41
30	40.24	1.12	22.19
60	36.78	1.14	20.59
90	38.53	1.67	18.86
120	38.18	0.65	17.44

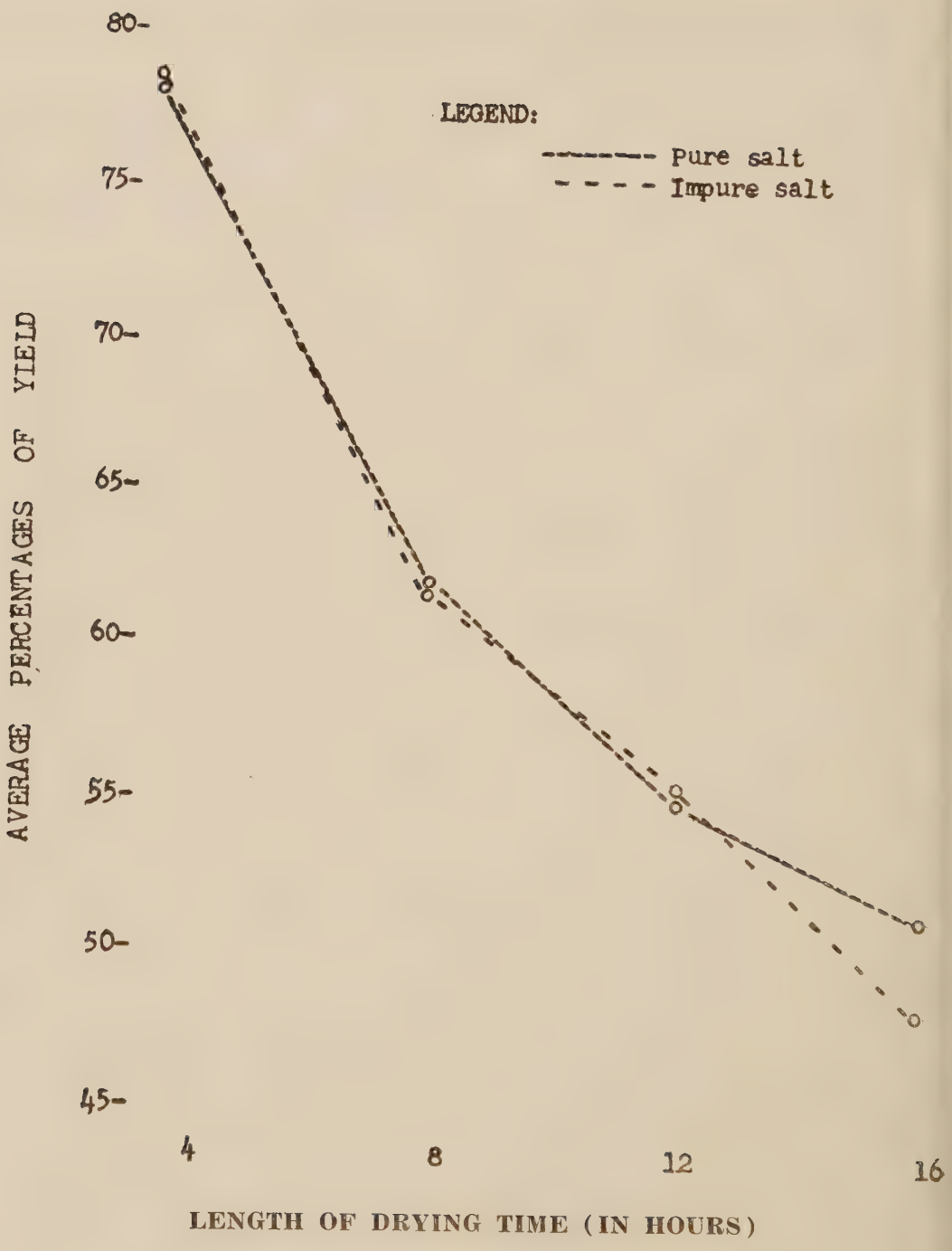

Fig. 1 Comparative weights in per cent of cured fish during the process of drying using pure and impure salts.

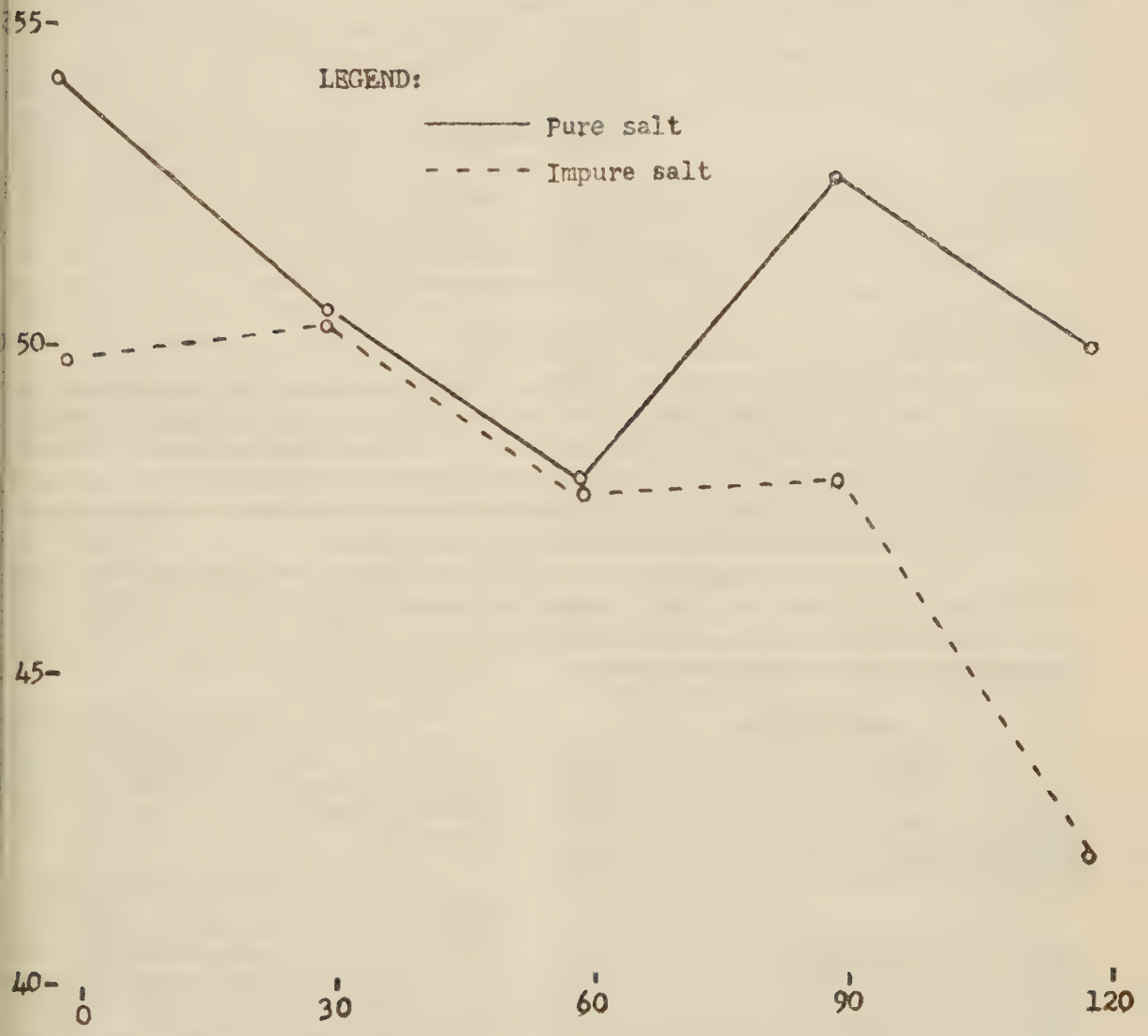

Fig. 2 Comparative average yields in per cent of dried split-salted bisugo *(Nemipterus* sp*)*. using pure and impure salts.

STUDIES ON THE PREPARATION OF DEHYDRATED SHARK MEAT

by
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ABSTRACT

Dehydrated fish meat, similar to fish flour is considered one of the cheapest sources animal protein. It is prepared from any of the steamed fish muscles of tuna, shark, round s and othep cheap species of fish. The addition of soy sauce and small amount of sodi glutamate (vet-sin) improves the taste and palatability of the final product.

Dehydrated shark meat with small amounts of dried carrots, celery, cabbage and pc dered white pepper is highly recommended as a palatable soup.

In the Philippines where the poor people live on rice and dried fish alone, the addit of dehydrated shark meat soup would enhance the improvement of the people's diet.

The chemical analysis of dehydrated shark meat reveals that it is highly compara with other sources of animal protein food.

INTRODUCTION

The manufacture of dehydrated shark meat was conceived to meet the all-time rising demand for cheap protein food vitally needed to improve the diet of the rapidly-increasing population of the world, not excluding the Philippines.

Food technologists, dieticians, nutritionists and various international food organizations are in search of cheap but high food value protein materials from the marine resources for growth and health of poor and underprivileged people.

One of the main causes of malnutrition is insufficiency of the amount of protein in the diet due to high cost of protein foods, such as milk, cheese, beef, pork and poultry that the common people could hardly afford. The availability, therefore, of cheap protein food to increase the food value of the ordinary diets thereby promoting good health among the people, and consequently a much stronger nation as a whole, is the crying need of the time.

Malnutrition causes more fatalitie tuberculosis, malaria and cancer, for its is basic, leading to the attacks of path microorganisms produced by the resu diseases.

Dietary deficiency leads to inac depression and apathy. In children, it r growth and development due to loss of and may cause physical inactivity, emo disturbance and and sometimes mental d The nutritional element mainly lacking inadequate diet is animal protein, w animal meat, fish, eggs or milk.

This study of preparing dehydrated meat was, therefore, conducted to help the aforementioned protein food deficie the people's diet, for fish is not only the ch but the most widely distributed source much-needed protein.

EXPERIMENTAL METHODS

Dehydrated fish meat may be pre not only from shark, but also from any

pecies of fish not hitherto relished by the ing public.

Shark of the *Scoliodon spp.* was used in idy, becaused of its abundance in Philip- larine waters.

Dressing. The skin was first removed unks of the flesh separated from the then precooked in an open steam for one nd 100 minutes at 10 lb. pressure; then set o cool completely. The cooked flesh was d and then macerated with varying ts of soy sauce and sugar (Table 1); then ried in the sun and lastly, smoked for minutes. The smoked material was then completely either in the sun or in an ally heated drier, after which the dehy- meat was passed through a wire screen m. mesh to obtain uniform size.

Packing. Twenty-gram weight of dehy- shark meat were packed in cellophane nd distributed to the consuming public al. Other packages contain dehydrated bles such as, cabbage, carrots, celery, salt dash of powdered white pepper.

Other important uses. Being a concen- protein food, a 20-gram package of ated shark meat mixed with two cups of water produced a nutritious soup recom- d for the rich and poor.

The food value may be improved greatly he addition of dehydrated chopped cab- carrots, celery, a dash of powdered white and tablespoonful of evaporated milk.

The incorporation of dehydrated shark n boiled rice *(lugaw)*, would improve its value. This product would serve fully s additive in many culinary Filipino dishes as, *pancit*, *ukoy*, vegetable soup, *pinakbet*, ot only to improve their food value, but ste and flavor as well.

Chemical analysis. Dehydrated shark was chemically analyzed and compared ther animal protein food (Table 2).

RESULTS AND DISCUSSION

The manufacture of dehydrated fish meat important step in the proper utilization of meat and other cheap species of fish that d in great quantities in many Philippine e waters. Shark meat has practically no ercial value in the Philippines, and the conversion of its flesh into dehydrated meat would be a boon to the shark fishing industry. The availability of this cheap protein food to the masses at very low price, which is within the reach of everyone would improve greatly the health, and lessen cases of malnutrition in this country.

Cooking process. Shark meat has that particular urea-smell and cooking the meat for not less than 100 minutes at 10 lb. pressure, eliminated greatly this particular oder.

Treating the shark flesh with acid to neutralize the alkaline compound seemed to eliminate the objectionable odor, but steaming the flesh for more than 1½ hours was found to be very satisfactory and more economical.

The incorporation of soy sauce and brown sugar improved the taste and final smoking of the product before complete drying, resulted in the production of a shrimp-like taste and flavor of dehydrated fish meat.

Tasting trials. Twenty-gram samples of dehydrated shark meat with 5 per cent each of dried vegetables, such as cabbage, carrots, celery, powdered white pepper, salt and evaporated milk were distributed to the consuming public for tasing trials or acceptance. They claimed that the product has shrimp taste and flavor and the addition of two cups of boiling water produced a tasty soup.

The laboring class who live mainly on rice and dried fish would improve their diet greatly with the addition of dehydrated shark meat soup in their meal.

Chemical analysis. The protein content of four experimental samples of dehydrated shark meat are much higher than any other animal meat, ranging from 59.10 to 40.07 per cent or an average of 50.35 per cent (Table 2), although the percentages of fat are rather low.

Fish proteins are 85 to 95 per cent digestible and biological studies revealed that all the dietary essential amino acids, which are needed to give growth and maintenance to the body are also present, and that an average serving of it would supply sufficient amount of animal protein to satisfy daily body requirement.

SUMMARY AND CONCLUSION

Fish flour had been prepared by the Bureau of Fisheries from various species of shark as

well as fish meal from cheap species of fish and cannery fish scraps. Dehydrated fish meat is a new product manufactured by the Technological Research Section of the Philippine Bureau of Fisheries.

This study was undertaken because of the waste of shark meat due to lack of proper know-how in its utilization and at the same time majority of the Filipino people do not relish shark meat, because of the psychological connection that sharks are man-eaters. Thus, to utilize this tremendous amount of highly expensive food item, which is protein, shark meat was used in this study.

The production of dehydrated fish meat with a shrimp-taste was accomplished by masking the fishy taste with good brand of soy sauce and other condiments.

Cooking the shark meat for 100 m at a pressure of 10 lb. was found very ef in eliminating the urea-like smell and fl the fish.

The product is well accepted by th suming public because of its shrimp-like which does not only increase the food va added to any dish, but give good flavor an as well. As an additive to many Filipino dehydrated shark meat will find its many

The chemical analysis reveals that drated fish meat is high in food value a lowering the moisture content to less than cent, the keeping quality would be enhanced.

Lastly, dehydrated shark meat wi addition of dried vegetables such as cabbag rots, celery, etc., is highly recommen improve the food value of various diets, a as impart good flavor and taste to them.

Table I. – Showing various treatments in the manufacture of dehydrated shark meat

Shark meat (raw) gm.	Cooking time min.	Smoking time min.	Weight after cooking gm.	Cooked shark meat gm.	Soy sauce used ml.	Brown sugar used gm.	Rem
I — 4,000	60	30	2,340	1,000	200	100	Open
II — 8,000	100	30	4,040	1,000	250	200	10 lb.
III — —	—	30	—	1,000	300	300	—
IV — —	—	—	—	1,000	—	300	+ 30 g Vet-si

ble 2. – Proximate Chemical Composition of Dehydrated Shark Meat Treated according to Table 1, compared with Other Animal Protein Products.

Dehydrated Shark meat	Moisture	Ash	Protein (N x 6.25)	Fats (E.E.)
No.	Per cent	Per cent	Per cent	Per cent
I	11.36	11.56	50.47	0.99
II	12.31	12.36	52.13	1.07
III	14.11	5.17	40.07	1.63
IV	9.91	12.00	59.10	0.31
er animal protein food :				
ef, dried	—	—	29.70	6.50
mb, broiled	—	—	21.20	29.70
rk, bacon smoked	—	—	9.90	64.80
Ham, smoked	—	—	20.20	20.80
eal, chops	—	—	19.40	10.00
icken, broiled	—	—	21.60	2.50
- - -, roast	—	—	25.00	11.10
ck	—	—	18.00	19.00

NOTES ON FISHERIES TECHNOLOGICAL RESEARCH IN THAILAND

by
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1. DRIED 'HOI KRAENG' *(ARC SHELL)*

Heavy production in Thailand in recent years of Hoi Kraeng (Arc Shell) which is solely consumed in fresh state, necessitated development of processed products of the shell. Earlier attempts for canning 'Hoi Kraeng' were described in notes presented to the 7th Session of the Indo-Pacific Fisheries Council (IPFC/C57/TECH 60). The present notes describe experiments in the development of a slightly salted and dried product.

After thoroughly cleaning in water for a few hours, the shells were brought to a boil in 10-16 Be' brine for about 10 minutes. The meat was shucked out and further boiled in water for a few minutes. The meat wa dried in a charcoal heated drying cabine hours at 50°-55°C and further at 60°-7 about 10 hours.

Data on the yield of the produc recorded and the product was analysed composition. It was also stored under d conditions in order to study its keeping c

The shucked meat makes up about the weight of fresh shell; the yield o product with about 15% of moisture w more than 4-5% of the fresh shells.

Analysis of one sample of Hoi meat before and after drying gave the fo data:

Composition of fresh and salted-dried Hoi Kraeng meat.

Constituent	Fresh meat (per cent weight)	Dried meat (per cent weigh
Protein	6.56	40.87
Fat	1.04	4.95
Moisture	86.2	22.9
Ash	1.18	6.34
Salt	—	2.17

At 26% moisture, the product would keep in good condition for only 1-2 weeks, while at 13 to 18% moisture, the keeping time was extended to 3-4 months. Average storage condition was 28°C air temperature and 70% relative humidity. Storage in open air caused the shells to spoil much quicker than when packed in containers. They were also more readily attacked by mold and insects. Packed i tainers and stored in a household refrig the product kept good for a considerab time.

To minimize the risk of spoil molds, the moisture content should there kept below 16% which is the upper lim

salted, dried fishery products in other
.es.

Further experiments in packing the pro-
polythene bags are planned.

BOILED PLA-TU *(RASTRELLIGER)*

Boiled fish particularly boiled 'pla-tu'
elliger) is a highly popular commercial
oduct in Thailand, particularly in the
ar removed from the coasts where fish is

Boiling of fish represents a very simple
expensive method for preserving fish
7 days under tropical conditions. This
ticularly significant as transportation
es for fish in Thailand are in general
able and inadequate.

In order to improve the product, particu-
ts keeping quality by standardizing pro-
g and handling techniques, a study was made of the practices in the industry for boiling 'pla-tu' and their effects on the product.

The processing method employed by the industry is: The fish are gilled, gutted and cleaned, then immersed in saturated brine for 30 minutes; 3-4 fish are placed closely side by side in a small bamboo tray; several of these trays are arranged in a basket and the basket immersed in a boiling saturated brine for 10 minutes. Fish prepared for local market are boiled once, and for distant maket twice. The boiled fish is allowed to cool before packing for shipment. The trays are arranged in a big wicker basket lined and topped with green banana leaves.

Pla-tu yields 78% of the fresh weight if boiled once and 75% if boiled twice.

The product had the following composition:

Composition of boiled 'pla-tu' *(Rastrelliger)*

Constituent	Once boiled (percent weight)	Twice boiled (percent weight)
Protein	19.25	22.75
Volatile Nitrogen	0.05	0.05
Moisture	64.84	60.48
Salt	3.63	5.60

Stored in open air, fish boiled once, kept
or 2 days, but for 7 days, if boiled twice.
stored in a household refrigerator, in 14
here were no visible signs of spoilage, but
sh became gradually too hard and firm
se of dehydration.

Further experiments in the packing of
iled fish in polythene bags are planned.

RIED-SMOKED 'PLA-TU' *(RASTRELLIGER)*

Pla-Tu *(Rastrelliger sp.)*, which is caught
nense quantities in the Gulf of Thailand,
present consumed as fresh or processed
alted fish and fish sauce. But because
cent heavy increases in the catch, the
men have often experienced difficulties
posing off their catch through the existing channels. In an attempt to develop new products of 'pla-tu', experiments were conducted on smoking the fish.

The fish was processed by exactly the same method as is applied for smoking fresh water fish. The fish were gilled and eviscerated, then washed and placed on the rack to drain. The drained fish were then treated for 30 hours with smoke generated with sawdust and coconut shell. The fish became hard dried and dark in color.

Attempts were then made to dry the fish first with charcoal fire at 60°-70°C. The product obtained had the same dryness but much better color.

Salting of fish in weak brine (14°Be'.) for 30 minutes or in saturated brine for 30 minutes before drying and smoking were also tried. The product so obtained had a cheese-like taste.

With a moisture content of 27-3 the product, the yield was about 25% by w of the raw material while with a moistur tent of 17-20%, the yield was about 22%.

The data on the composition of smoked 'pla-tu' are given below:

		Composition of dried smoked 'Pla-tu' (*Rastrelliger*)				
Sample	Salting prior to smoking	protein (percent weight)	Fat (percent weight)	Moisture (percent weight)	Salt (percent weight)	Remarks
1	30 minutes in saturated brine	—	—	29.64	3.45	
2	30 minutes in 14° Be. brine	—	—	17.00	1.30	
3	No salting	57.61	17.01	9.48	—	Dried 2 da in the sun
4	,,	60.55	17.09	8.32	—	,,
5	,,	61.21	13.02	11.86	—	Dried 1 d in the sun
6	,,	59.23	14.35	13.08	—	,,

Stored in baskets in open air, the product was attacked in 1-2 weeks by a kind of beetle. In 1-2 months this insect ate the whole body of the fish or caused it to become powder-like.

Attempts are now being made to proper insecticide. Experiments in pack the fish in polythene bags are also planned

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STORAGE OF DRIED FISH

by
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ABSTRACT

Batches of Ikan Bilis (*Stolephorus* sp.), Ikan Gelema (*Sciaena* sp.) and Selar Kuni (*Caranx* sp.) were dried for 1½ days in the bright tropical sun and packed in 4-gallon ker sene cans and sealed in an atmosphere of air, and carbon dioxide. Sample weres taken o periodically and the fish examined for quality through a taste panel. Bilis remained excelle even after 6 months, both in the air and carbon dioxide pack. The other two varieties det iorated much quicker in the carbon dioxide pack than in air. The Selar became absolute unfit for human consumption after about 4 months both in the air and carbon dioxide pack. is suggested that the keeping of Bilis is attributable to drying to a satisfactory degree befo it was packed; the fish due to its small size having completely dried in about 1½ days and t moisture content in the other two varieties which are large in size, having been rather hi at the time they were packed. Further experiments are planned.

CONTRIBUTION A L'ETUDE DU NUOC-MAM CONDENSE AU VIETNAM

par
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Si le "nuoc-mam" est encore ignore de ins pays du monde, il est très connu des du Sud-Est Asiatique en particulier du odge, du Laos, de la Thailande, des Philip- etc... Préparée de facon analogue dans les ents pays, cette sauce est appelée "Nam- en thailandais, "Patis" en philippine...

On peut définir le produit comme suit : Le -mam, résultat de la macération du poisson une solution concentrée de sel marin, est tiellement une solution salée de matières inoides a un certain degré de désintégra- cette dissolution doit contenir une propor- le sel suffisante pour assurer la conservation des produits azètes résultant de la désintégration des matières albuminoides.

Bien des auteurs ont analyse le nuoc-mam et y ont trouvé au point de vue chimique :

a/-des matières azotées

b/-des élements mineraux : chlorure de sodium
phosphère
calcium
magnésium
souffre
brome et iode
arsenic

c/-des vitamines B 12, PP

COMPOSITION CHIMIQUE DU NUOC-MAM

(en grammes par litres)

ne et qualité du nuóc-mám	NaCl	N Total	N Organique	N Formol	N Ammoniacal	N Aminé	Tryptophane	Tyrosine	P_2O_5	Ca O	Mg O	F_2O_3
uôc, qualité upérieure (1)	213	26,7	22	17	4,7	12,3						
hiet, qualité upérieure (1)	269	25,	21	16,4	4,1	12,3						
ietnam, première ualité (2)	270	15,8	11,1	9,7	4,7	5	0,57			0,41	2,208	0,008
— , deuxième ualité (2)	286	12,1	8,2	7,7	3,8	3,8	0,37			0,439	2,310	0,011
Vietnam, qualité upérieure (2)	276	19,3	15,7	12,3	3,6	8,7	0,86		0,565			
— , deuxième ualité (2)	247	6,9	5,5	3,2	1,1	1,8	0,17		0,266			
uôc, qualité upérieure (3)	259	29,5	24,2			7,7		2,400				
hiet, première ualité (3)	268	18,2	14			6		2,000				
é, troisième ualité (3)	298	8,9	6			2		1,210				

(1) — D'après ROZE, moyennes calculées sur plusieurs échantillons analysés
(2) — D'après AUTRET et BONVIER.
(3) — D'après VIALARD-GOUDOU.

Au point de vue alimentaire, des recherches sur la composition en acides aminés montrent que le nuóc-mám représente une source trés importante de l'ensemble des acides aminés indispensables; on peut dire en conséquence que ce liquide joue un rôle que l'on peut qualifier de providentiel pour compléter la ration alimentaire de la masse laborieuse de certaines populations asiatiques en produits azotés indispensables à la croissance et au maintien de l'équilibre azoté protidique.

Pour les Vietnamiens, c'est un condiment qui est servi à tous les repas, soit consommé en nature, soit assaisonné aux mets (viandes, légumes...).

Pour une consommation quotidienne de nuóc-mám de 40 grs. par personne, on a 0g. 6 d'azote soit 7,5 o/o de la ration azotée totale, apport qui est loin d'être négligeable.

Les centres de fabrication du nuóc-màm sont de préférence situés dans les centres de pêche maritime, jalonnés le long des côtes ou sur les rives des grands cours d'eau, là où les genres de poissons aptes à la fabrication du nuóc-mám sont abondants (Stolephorus, Decapterus, Dorosoma, Clupea, Engraulis, Thynmichthys, etc, etc...

Une fois la fabrication terminée, il faut penser à acheminer ce liquide vers les centres de consommation - Sachant que les deux éléments constitutifs essentiels du nuóc-mám sont le sel et les acides aminés et que le chlorure de sodium en solution concentrée devient corrosif et attaque tout sauf le bois, le verre et les matières céramiques, les saumuriers vietnamiens utilisent jusqu'à ce jour des touques cylindriques en bois de vingt à cinq litres, des anciens tonneaux et tonnelets de vins de 200 à 50 litres, des jarres en terre cuite de 2l·500 à 3 litres. Mais tous ces emballages s'avèrent très encombrants, trop lourds et très exposés à de fréquentes casses durant le voyage qui se fait par train, bateaux, sampans, camions; ou lors des manutentions à l'embarquement et au débarquement.

Des recherches sur l'amélioration du conditionnement ont été effectuées par de nombreuses personnes intéressées à la question de transport du nuóc-mám. L'usage des récipients en plastic a été également préconisé, mais ces expériences n'ont été jusqu'ici couronnées de succès car le nuóc-mám ne se conserve pas dans ces récipients après un certain temps, - à partir de la 2ème semaine il finit par changer d voire même de composition.

Quelle pourrait donc être la solutio porter au transport de ce liquide? Nous p qu'il serait intéressant de fabriquer du nuó solide par l'un des procédés de déshydr qui consiste à enlever, si possible, la totalité de l'eau contenue dans le nuoc sans endommager en rien à ses principes tiels.

Les procédés de déshydtaration du mám peuvent être nombreux mais n notons ici que les principaux:

1.-Procédé par évaporation au bain
2.-Procédé par évaporation dans l
3.-Procédé par atomisation.

Parmi tous ces procédés, nous choisi le premier procédé qui ne nécessite installation coûteuse - dont voici la desc sommaire.

Sur un foyer au feu doux, est dispo marmite en métal émaillé à double fond; inférieur est rempli d'eau, tandis que l mám à solidifier est mis dans la marmite eure à large ouverture. Le nuóc-mám n pas ainsi l'cation directe du feu qui ris de calciner le nuóc-màm vers la fin de tion.

Afin de faciliter voire même accé déshydratation, deux dispositifs très sim été employés:

1.-un cylindre en métal émaillé es tenu plongé dans le nuóc-mám à so cylindre qui, mû soit à la main soit à l'aid moteur, déclenche un mouvement ro agitant ainsi le liquide à condenser et a tant ainsi la surface d'évaporation,

2.-un ventilateur souffle d'autre p la surface du liquide chasse encore plus ment la vapeur d'eau exhalée.

(Voir desin).

Nous avons dans notre laboratoire expériences sur différents catégories de mám:

Nuóc-mám Phú-Quóc *(qualité supérie*
-Azote total : 23g.6 le litre
-Azote ammoniacal : 2g.52 le litre
-Azote formol : 13, 20 le litre

ốc-mám Nam-O *(qualité superieure)*

Azote total : 21g.00 le litre
Azote ammoniacal : 0,50 le litre
Azote formol : 10,08 le litre

ốc-mám ordinaire *(2ème qualité)*

Azote total : 14g.00 le litre
Azote ammoniacal : 3,92 le litre
Azote formol : 7,51 le litre

Aprés l'évaporation qui dure de 3 à 5 pour 2 ou 3 litres de nuóc-mám, on a des produits suivants :

Au point de vue macroscopique :

le nuóc-mám Phú-Quõc: une pâte très jaune pâle,

le nuóc-mám Nam-O : Une pâte jaune

le nuóc-mám ordinaire : des cristaux foncè.

b/Au point de vue chimique :

-Nuóc-mám Phú-Quoc solidifié :

Azote total : 4.130/100 grs en cube
Azote ammoniacal : 0.322/100 grs en cube
Azote formol : 2.060/100 grs en cube

-Nuóc-mám Nam-O solidifié :

Azote total : 4.900/100 grs en cube
Azote ammoniacal: 0.387/100 grs en cube
Azote formol : 2.352/100 grs en cube

Dans la fabrication du nuóc-mám solide, re de nuóc-mám donne en moyenne 300 à rs de pâte; ainsi pour refaire un litre de -mám il suffit de dissoudre 300 à 350 grs uóc-mám solide dans une quantité nécessaire pour avoir de nouveau du -mám consommable.

De ce qui précéde, nous pouvons conclure que le nuóc-mám solide présente des avantages suivants :

-une grande partie, presque la totalité de l,eau que contient le nuóc-mám, est évaporée,

-le pourecntage d'azote ammoniacal, azote toxique et non assimilable, est faible,

-le nuóc-mám solide ainsi fabriqué se transporte facilement car il est peu encombrant, de manutention facile et le prix du frêt est réduit,

-le nuóc-mám solide fabriqué par le procédé par évaporation au bain-marie ne s'avère pas coûteux. Avec un matériel peu compliqué, d'une manipulation simple, tout saumurier peut fabriquer du nuóc-mám solide, dont un kilogramme ne coûterait que dans les environs de cent piastres à cent vingt piastres, compte tenu des frais de main d'oeuvre, de chauffage, d'amortissement du matériel, avantage qui s'ajoute aux trois premiers pour faire de ce condiment un produit qui devrait être préféré du public et surtout de l'Armée.

Signalons cependant une petite incommodité dans la conservation : Le nuóc-mám solide, de par sa forte teneur en chlorure de sodium, est hygroscopique.

Il est donc recommandable de le conserver sous papier cellophane imperméable ou dans des vases hermétiques.

En somme, le procédé d'évaporation par bain-marie est un procédé très simple facilement mis en pratique parles saumuriers. Ceux-ci peuvent mettre sur pied avec facilité une organisation industrielle de fabrication en vue même de l'exportation.

NOTES ON TESTS IN THAILAND ON THE ACCEPTABILITY OF GOOD QUALITY FISH MEAL FOR HUMAN CONSUMPTION

by
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Tests on the acceptability of good quality fish meal for human consumption were sponsored in Thailand jointly by the Department of Health and the Department of Fisheries. The tests were carried out by trainees of the Thailand-Unesco Fundamental Education Project, under the supervision of the Nutrition officers of the FAO Far East Regional Office.

Fish meal instead of fish flour was used in the tests as the fish flour was very expensive and as fish products e.g. fish sauce (nam pla) and shrimp paste, which according to western standards have disagreeable odor, are already popular items in the Thai diet.

The meal used in the tests was produced locally from 'pla-thu' (*Rastrelliger* spp.) and some slipmouth at a fully mechanized fish meal plant at Chumphorn about 450 km. south of Bangkok. Before its use in the tests, the meal was analysed chemically and bacteriologically. Only good quality and pathogen-free batches were used. Where necessary, fish meal from commercial sources was sterilized before the tests. The table below gives the composition of the meal tested:

Table 1: Typical composition of fish meal tested for acceptability in Thailand for consumption.

Protein	...	64.00%
Fat	...	7.10%
Moisture	...	7.30%
Ash	...	21.20%
Phosphorus	...	3.58%
Calcium	...	7.80%

The accompanying table records results of bacteriological analysis of samples of commercial fish meal and those prepared in the Technological Laboratory of the Department of Fisheries, Bangkok.

Table 2 Bacterial content of commercial fish meal and of those prepared in the laboratory

Sample No. and source	Raw material and processing method	Bacterial Count per gram	*E. coli*	*Clo*
A. Commercial fish meal	Herring spp., processed in a fully mechanized plant, sample 4-6 months old	20,000,000	+++	+
B. "	Sample A but fresh	2,900,000	+	
C. "	Slipmouth spp., processed as in A, 2 months old	7,000,000	++	
D. "	Sample A further sterilized at 15 lb. steam pressure for:			
	1.0 hour	1,100	–	
	1.5 "	24	–	
	2.0 "	20	–	
	3.0 "	20	–	

2 Continued

aple No. source	Raw material and processing method	Bacterial Cunt per gram	*E. coli*	*Clostridia*
Meal prepared in the laboratory	Slipmouth spp., brined for 45 hours in 25° Be brine before processing into meal	594,000	—	—
,,	Slipmouth spp., immersed for 45 hours in brine kept saturated and then processed into meal	66,000	—	—
,,	Slipmouth spp., not treated with brine before processing	290,000	—	—

Ten grams of the meal (equivalent to protein and 0.5 - 0.7 calcium) was given school lunch for 5 days a week for one to 136 school children (7 - 12 years old) of orn village, Ubol Province, and to 130 n of the Chat Songkram School, Bangkok.

In addition, 25 Bangkok families in the come brackets and 150 families of Nongllage in the Ubol Province, known for its hortage of animal protein, received daily of 15 g. of the meal per head.

The meal was served to the school children rent preparations including curries, vegetable dishes, and fish pastes, the recipes for which were supplied by the Department of Health, while the families received instructions for the preparation of the dishes according to the recipes.

Between 75 - 100% of the children in the Bangkok school liked the meal served in four of the six recipes; while 75 - 90% school children in Nongkorn village almost equally liked six of the seven different preparations in which the fish meal was served; 63% of the families in Nongkorn village favored acceptance of the meal for food while Bangkok families did not care for it at all.

Table 3 Results of tests on acceptability of fish flour for human consumption.

st bjects	Recipes	Favored (Number of children)	Not favored (Number of children)
	1. Sweetened fish flour paste sauce	130	—
	2. Fried pork with chillies	110	20
ldren	3. Fish flour paste	100	30
of	4. Vegetable soup (seasoned)	97	33
ngkok	5. Cooked shrimp paste with fish flour	95	35
ool	6. Vegetable soup (plain)	82	48
	1. Pat Pric King (Fried chillies paste)	115	21
	2. Pumpkin curry	114	22
ldren	3. String bean curry	112	24
	4. Vegetable soup	111	25
ngkorn	5. Raw papaya seasoned	108	28
lage	6. Bamboo shoot curry	103	33
	7. Fermented fish paste with fish flour	86	50

The reasons given by the Bangkok families for their non-approval of the flour were: (1) The particular batch of the flour on test was not very satisfactory; some test subjects reported that it had offensive odor, (ii) a wide choice of palatable dishes are available in Bangkok, and (iii) the housewives did not strictly observe the instructions in the recipes; it was claimed that some of the recipes required too many ingrediants and were difficult to prepare and that in spite of faithfully following the recipes it was not always possible to make the dishes appetizing.

It was attempted to ascertain if the test subjects (families) would care to buy the flour if it were offered at a reasonable price. (at 4 Bahts (US$ 0.20) a kilo only 12% wer ing to buy.

Further tests were planned, and to in the quality of the meal further, the produc advised to improve hygiene and sanitat the plant, modify the processing to ensur plete destruction of pathogenic bacteria, meal to a moisture content of 8%, grind th into finer particles, sieve the coarse bon ticles off, pack the meal in moisture-proof lined paper bags or tin cans, and not to o meal for human consumption if stored fo than six months.

NOTE SUR LA PREPARATION DE FARINE DE POISSON A PARTIR DES RESIDUS PROVENANT DE LA FABRICATION DES GRAISSES DE POISSONS D'EAU DOUCE DU CAMBODGE: UTILISATION DIRECTE DANS L' ALIMENTATION DES VOLAILLES DE LA FARINE NON DESHUILEE

par
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RESUME

Il est possible de faire récupérer par les pêcheurs, sur chaque pêcherie, les résidus venant de la fabrication des graisses de poissons d'eau douce. Le résidu sec obtenu du seulement 3 riels le kilo pout tripler le bénéfice du pêcheur qui retire, pour 100 kg. petits poissons, environ 10 kg. de graisse et 20 kg. de résidus secs.

Ce résidu sec, simplement broyé donne rine de poisson contenant 50% de protéine de matières grasses.

Ce taux élevé de graisse pourrait faire ce que cette farine ne communique le e poisson à la chair et aux oeufs des s qui en consomment.

Or, si on doit déshuiler les déchets secs, ais de traitement, de transports et le e des intermédiaires porteront le prix de e de poisson à 8 ou 9 riels le kilo au lieu els si on ne déshuile pas.

Vingt-cinq tonnes de déchets secs ré- lors de la dernière campagne ont donc ansformés en farine sans avoir été lées. Le Service Vétérinaire a utilisé nes de cette farine à 18% de graisse sans trer de difficultés. Nous avons nous expérimenté cette farine grasse dans ge de porcs, de canards, de dindons, sans remarquer un mauvais goût de la chair oeufs des animaux en ayant consommée.

Nous pensons que la graisse de poisson douce, qui contient beaucoup moins s gras non saturés (indice d'iode 90) que les de poisson de mer (indice d'iode 150), risque moins de donner le goût de n aux animaux qui en consomment.

INTRODUCTION

Le Combodge dispose chaque année de tés énormes de petits poissons pour ils il n'existe pas actuellement de débouchés suffisants. Une partie est utilisée pour la préparation de pâte et de sauce de poisson, le reste étant le plus souvent abandonné. Lorsque le cours mondial des matières grasses est élevé, les pêcheurs font bouillir ces petits poissons pour en extraire la graisse; après cuisson, les déchets, constitués par la chair et les arrêtes, sont abandonnés. Autrefois, la production des graisses de poissons d'eau douce du Cambodge atteignait 4 à 5.000 tonnes par an. Sur ce tonnage, 3 à 4.000 t. provenaient du traitement de petits poissons, le reste étant obtenu à partir des têtes et tripailles laissées par la fabrication du poisson salé-séché. Le rendement moyen du petit poisson en graisse est environ 10%, ce qui permet d'évaluer à 30.000 tonnes les quantités de petits poissons disponibles chaque année pour la préparation des graisses de poisson.

Depuis quelques années la production des graisses de poisson a beaucoup baissé, leur prix trop bas ne couvrant plus les frais de fabrication: bois de chauffage, main d'oeuvre, etc. Or, cette fabrication pourrait redevenir rentable si, après extraction de la graisse, le pêcheur récupérait les déchets qui sont habituellement jetés. Convenablement séchés, ces déchets peuvent être transformés en une farine de poisson utilisable dans l'alimentation des volailles et des porcs.

1000 kg. de petits poissons donnent environ 10 kg. de graisse et 20 kg. de déchets secs. En évaluant les déchets secs à un prix même très bas, 2 riels le kilo, voisin du prix de la graisse de poisson, on voit que le rende-

ment de l'opération est triplé. Ce résidu sec, après simple broyage (coût: 0,5 riels par kilo), donne une farine de poisson qui peut être utilisée directement pour l'alimentation des volailles, et dont le prix reste très inférieur à celui de la farine de poisson importée qui atteint 7 et 8 riels le kilo. Il existe déjà au Cambodge quelques élevages industriels, comptant plusieurs de volailles chacun, qui ont absolument besoin milliers de farine de poisson pour équilibrer la ration qu'ils utilisent. En général, on ajoute de 10 à 20% de farine de poisson à la ration composée principalement de céréales et de sous-produite (son, farine). L'Aviculture pourrait se développer au Cambodge, car on y trouve, à très bas prix, du Mais et des sous-produits de l'usinage du riz (son, farine, brisure) qui constituent des aliments parfaits pour l'élevage des volailles. Ainsi, en 1957, le Cambodge a exporté 99,000 tonnes de Mais et 36,000 tonnes de Farine de riz pour une valeur totale de 236 millions de riels. Utilisés sur place pour la nourriture des volailles (canards), on y ajoutant 10,000 tonnes de farine de poisson, on aurait pu obtenir une valeur à l'exportation au moins trois fois plus élevée.

RECUPERATION DES SURPLUS DE LA PECHE EN EAU DOUCE POUR LA PREPARATION DE FARINE DE POISSON

Les conditions spéciales de la pêche en eau douce au Cambodge: étendue de la zone de pêche, périodes très courtes pendant lesquelles les prises sont abondantes, température élevée causant une altération rapide du poisson, rendent obligatoire le traitement du poisson sur place par les pêcheurs. Une méthode de traitement simple, préconisée par l'Institut National des Recherches Piscicoles, permet de récupérer le petit poisson intutilisé sur chaque pêcherie (Voir I.P.F.C./C 55/Tech. 33 Food). Le poisson est d'abord mis à bouillir selon la méthode locale d'extraction des graisses de poissons; le résidu, constitué par la chair et le squelette des poissons, est passé dans une presse à vis très simple, manoeuvrée à la main. L'opération de pressage ne dure que 20 minutes et permet cependant de ramener la teneur en eau des résidus de 70 à 55%. Ainsi, 100 kg. de petits poissons, après cuisson, donnent environ 10 kg. de graisse et 60 kg. de résidus humides qui, passés à la presse, abandonnent 20 kg. de liquide (eau, graisse) et laissent 40 kg. de matière pressée. Après séchage au soleil, on obtient environ 20 kg. de déchets sec à 10% d'hu capables de se conserver plusieurs moi résidu humide tel qu'on l'obtient à la sor marmites, contenant 70% d'eau, ne peut p séché directement au soleil, la proportion est trop élevée, le séchage dure trop long ce qui permet le développement des fer tions putrides et la prolifération des vers. de la dernière campagne de pêches (1957- l'Institut des Recherches Piscicoles a ten expérience pour faire récupérer par les pê leurs déchets. Il a été commandé à une prise de construction mécanique de P Penh, 10 presses à vis pouvant traiter e 200 kg. de déchets humides par opé Ces presses ont été prêtées gratuitemen pêcheurs, et de plus, l'Institut s'est eng leur acheter leur production de déchets s prix de 3 riels le kilo. De décembre 1 mars 1958, il nous a été livré 25.600 déchets secs.

FARINE DE POISSON

Par simple broyage de ces déchets on obtient une farine de poisson conten moyenne 50% de matière protéique et à 18% de graisse.

Il était à craindre que cette prop élevée de matière grasse restant dans la de déchets ne rende impossible son utili directe dans l'alimentation des animaux effet on constate souvent que la viande oeufs d'animaux ayant absorbé des f de poisson grasses présentaient un goût gréable. Si cela devait se produire, il devie indispensable de déshuiler les déchets avant de les utiliser pour l'alimentatio animaux. Du point de vue pratique, il y là un très grand inconvénient. En effet l'u tion des déchets sans déshuilage perm aux aviculteurs de se procurer directeme les pêcheries les déchets secs dont i besoin, tout en payant un prix rénumérate pêcheurs, 3 riels le kilo, la farine obtenu broyage leur revenant cependant à moin riels le kilo. Comme il existe des centai pêcheries réparties sur les fleuves, rivièr lacs du Cambodge, les éleveurs pourront p toujours se procurer des déchets secs d voisinage de leur exploitation. Ils n'auron effectuer un simple broyage des déchet pour obtenir une farine alimentaire.

Au contraire, si le déshuilage se révèle ensable pour rendre utilisable la farine, e cette opération nécessite l'installation usine de traitement, il faudra d'abord ser le ramassage des déchets secs et leur ort à l'usine. Après traitement, il faudra ribuer la farine dans les provinces. Toutes érations entraineront des frais auxquels ont s'ajouter les profits des différents édiaires. Le prix de la farine pour teur atteindra 8 ou 9 riels le kilo. Il est preès certain que le prix payé aux pêcheurs e déchet sec sera réduit au maximum, seul de traitement se portant acheteur.

Nous en avons conclu qu'il serait primor- e déterminer, avant d'entreprendre un le déshuilage, si la farine brute, contenant e graisse, était utilisable ou non pour entation des animaux.

SATION DE FARINE DE POISSON NON ESHUILEE DANS L'ALIMENTATION DES ANIMAUX

Nous avons tenté d'utiliser directement tonnes de déchets secs récoltés cette en les transformant en farine de poisson. imple broyage nous avons obtenu une brute contenant 18% de matière grasse. farine a été cédée aux utilisateurs au prix t 4 riels le kilo.

Le principal acheteur de cette farine a Service Vétérinaire, (une dizaine de s). Dans une lettre du 30 août, le Direc- nous informait que: "l'alimentation des s et des volailles dans diverses fermes de ervice avec la ration contenant de la farine isson de 2ème qualité, non déshuilée, au le 18% de matière grasse, a donné jusqu'ici ésultats assez satisfaisants et n'a causé ennui".

En même temps nous entreprenions nous- s, à la Station, un essai de cette farine 'élevage de porcs (6), de canards (75) de pondeuses (plus de 3,000 oeufs) et de ns (180). La ration utilisée était com- de:

Son de riz	50%
Mais moulu	30%
Farine de poisson	15%
Minéraux	5%

Cette expérience, qui dure depuis près de 2 ans, nous a permis de constater que ni la viande ni les oeufs des animaux ayant reçu de la farine de poisson à 18% de graisse ne présentaient de mauvais goût. A la dose utilisée, 15% l'efficacité de cette farine de poisson est considérable. Nous avons obtenu des canards pesant en moyenne 2.15 kg. à 2 mois ½ pour une dépense de 6.25 kg. du mélange ci-dessus. Le rendement moyen en oeufs a été de 199 par cane les 10 premiers mois de ponte.

DISCUSTION

Il semble à première vue que les résultats abtenus avec cette farine de poisson non déshuilée, contenant 18% de graisse, soient en contradiction avec l'opinion de la plupart des avicultuers que les farines de poissons ayant plus de 5 à 6% de graisse risquent de donner "un goût de poisson" aux oeufs et à la chair des animaux qui en consomment. Nous pensons que cette anomalie peut s'expliquer par la différence de composition qui existe entre la graisse contenue dans cette farine de déchets de poissons d'eau douce et l'huile des farines préparées avec des poissons de mer. La graisse de poisson d'eau douce du Cambodge est relativement pauvre en acides gras non saturés, son indice d'iode est en moyenne de 90. Au contraire, l'huile des poissons de mer le plus souvent utilisés pour préparer les farines de poisson vendues dans le commerce (Menhaden, sardine) est très riche en acides gras insaturés (indice d'iode de 150 à 180). Or, il est reconnu que ce sont les acides gras non saturés qui donnent le goût de poisson.

CONCLUSION

Nous pensons qu'il est possible d'utiliser directement les déchets secs produits par les pêcheurs en les transformant en farine par simple broyage. En supprimant le déshuilage, la farine brute obtenue restera très bon marché pour l'aviculteur, 3 à 3,50 riels le kilo, tout en assurant un profit suffisant aux pêcheurs.

ENGLISH SUMMARY

It is possible for the fishermen to utilize the residues from the manufacture of fresh water fish oil. The dry residue, at present, sold at only 3 riels per kg., can increase threefold the earnings of the fishermen who produce about

10 kg. of oil and 20 kg. of dry residues from 100 kg. of small fish.

This dry residue, simply ground, makes fish meal containing 50% protein and 18% fat.

This high fat content raises the problem of any likely development of fishy odor in the meat and eggs of poultry fed on the meal.

The extraction of fat from the meal would raise its cost of production to 8-9 riels per kg. as against 4 riels per kg. for the meal from which the fat is not extracted.

Twenty five tons of residues gathered during the last season was converted into meal without extraction of the fat. The Vete Service used 10 tons of this meal with 1 without meeting with any difficulties. W experimented with this kind of meal ou in rearing porks, ducks and turkeys, w having experienced any bad odor in the m eggs of the animals which consumed it.

We think that the oil of the fresh fish which contains much less unsaturate acids (iodine value 90) than the oil of s is less likely than the latter, to im fishy odor to the meat and eggs of consuming it.

UTILIZATION OF FISH LIVER RESIDUES

by
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SUMMARY

Liver residues, after extraction of oil, may be converted into stable hydrolyzates by king with 33% salt and 1% papain and separating the liquid after about two weeks. A re palatable product of higher nutritional value is obtained when the liver residue (75-85% isture) is mixed with an equal weight of yeast slurry (85% moisture) to which is added % salt and 1% papain. After two weeks the mixture is filtered and 2% citric acid added a further preservative. If the papain is omitted, the conversion still takes place but uires six weeks for completion. When the liquid is ripened in the sun for about a ek, the aroma is considerably improved. The liquid, neutralized if necessary, may be d as a food supplement, as sauce or in animal feeding.

INTRODUCTION

The Government Fisheries Factory at al has a fish liver oil plant in which oil is rcially extracted from fish livers. The esidues after oil extraction are discarded y putrefy within a day or two. As fish esidues are known to be a source of a, vitamin B_{12} and other nutritional fac- Guttmann 1955), a method was sought reserving these residues or converting o a stable form so that they can be used ood supplement for animals or even for n consumption.

MATERIALS AND METHODS

In the commercial process used in the nment Fisheries Factory, oil is removed team rendering process from mixtures of l varieties of big fish including sharks, , rays and tuna. Whenever a poor yield is obtained, the livers are given a further treatment. When good yields of oil are ed at the first stage, very little oil is red by alkali treatment in the second so that this treatment is dispensed with h cases. If the liver residues are to be d as food, it is considered better to avoid e of alkali, especially as alkali treatment detrimental effect on Vitamin B_{12} activity nann and Vandenheuval, 1952). Therer this work the raw material experimented s steam rendered liver residues untreated ali. These residues had approximately 15% protein with 80% moisture and 5% oil and were neutral in reaction.

A simple method of preserving a protein material is to hydrolyze the protein in it into more stable amino acid mixtures as done in the traditional Far Eastern method of preparing fish sauce where the proteins of fish flesh are hydrolyzed by the enzymes in fish gut, in a salt pack, to form the sauce (Ling 1956). Accordingly experiments were directed along these lines in order to obtain a similar stable hydrolyzate from liver residues.

Liver is one of the principal sources of vitamin B_{12} which is used in the treatment of pernicious anaemia. The other vitamins of the B-Complex are all found in appreciable amounts in yeast (Tauber 1949). The addition of yeast to the liver hydrolyzate will therefore constitute a single source of all the B-vitamins as well as proteins from both the liver and the yeast. As the liver hydrolyzate was expected to be a clear liquid like fish sauce, the yeast too will have to be hydrolysed to a liquid to make the mixture homogeneous. Therefore experiments to obtain a yeast hydrolyzate were also initiated along with the liver experiments.

Yeast is obtainable as a by-product from fermented coconut toddy, which is the base for distilled spirits (Seeduwa distillery), or from the fermentation process used in the manufacture of beer (Nuwara Eliya brewery). The Seeduwa distillery does not sell its excess yeast at present but Nuwara Eliya brewery

markets dried yeast for use as a poultry food. Yeast can be hydrolyzed by its own enzymes (autolysis) but the solution decomposes unless stabilized. Autolysis of both coconut toddy yeast and brewer's yeast were attempted using salt as a preservative.

EXPERIMENTAL RESULTS

The hydrolyses of liver residues and yeast were first attempted separately. Liver residues even when saturated with salt decomposed rapidly showing that insufficient enzymes were present to hydrolyze the material. As an external source of proteolytic enzymes, papain was the most readily available and the easiest to use as it is active in neutral and acid ranges or pH (Tauber 1949).

Various concentrations of salt and papain were tried on the liver residues using from 0 to 50% salt and ½ to 5% papain. The minimum amounts necessary to hydrolyze the residues without decomposition were found to be 33% salt and 1% papain. The hydrolyzate produced can be filtered to give a clear liquid somewhat like fish sauce except that it lacked the aroma and flavor of sauces prepared from whole fish.

Coconut toddy yeast was obtained from fresh coconut toddy which was allowed to ferment for 24 hours. The growing yeast settled down and the upper liquid layer was decanted to leave a suspension of yeast. However, this suspension proved too dilute and the various preservative methods failed until the yeast was first centrifuged to a slurry containing approximately 85% moisture. The brewer's yeast was sold in a dry form containing 15% moisture. To obtain satisfactory results, this had to be mixed with 20% water so that the slurry had a moisture content of approximately 85%. Both slurries contained 5 to 10% protein.

With both types of yeast, 2% salt and sufficient chloroform to saturate the water present in the slurry produced a stable hydrolyzate. Decomposition occurred when chloroform was not used even with the addition of a top protective layer of amyl alcohol or groundnut oil or kerosene oil. Addition of papain to the salt failed to prevent decomposition while saturated salt appeared to stop or considerably slow down the action. Boiling or autoclaving the mixture stops the autolysis.

A simple method of following bo hydrolysis of the liver residue as well hydrolysis of yeast was by means of the (formaldehyde) titration (A.O.A.C. 1950) method estimates amino acids present th the acidity produced by their condensat the presence of formaldehyde. A portion hydrolyzate is first neutralized, neutral f dehyde added and the acidity developed t is titrated. This titre is proportionate amino acids present and when it rea constant value, shows the hydrolysis to b plete. The time taken for complete hyd was about two weeks for both the liver a as the yeast.

The effect of mixing the liver re and yeast slurries was tried next. Du runs of liver and yeast hydrolyzates were and one set was mixed together at the be of the test and the other set mixed at t of two weeks, so that one set was hydroly a mixture and the other set was hyd separately and then mixed. The same titration was obtained in both cases sh that the same degree of hydrolysis took p the mixed batch as in the individual pc Chloroform was found to be super-flu mixed batches as batches without it gav results. Thus it was shown that a stable hydrolyzate can be prepared using equa of liver residue and yeast slurry to wh added 17% salt and ½% papain.

In experiments to reduce the amo salt used, it was found that when 2% sa used the mixture decomposed in 2 days 5% salt in 7 days and with 10% salt in 1 The 15% salt mixture was stable. Wit residues alone, 15% salt is not sufficie prevent fungus growth. With yeast alon salt slows down but does not stop the hyd (as shown by formol titrations). For f work the salt content was therefore re to 15%.

When papain was omitted the hyd proceeded very slowly taking about six to complete, but no decomposition oc This shows that yeast can supply the en necessary to hydrolyse liver residues a as a substitute for papain. This is p because the proteolytic enzymes of yeast ble those of papain in many respects (T 1949). However the optimun concentrat papain required for rapid hydrolysis w

ydrolysis of equal parts of liver residue ast slurry with 15% salt and 1% papain bout two weeks after which the product filtered to give a clear liquid.

It was noted that the hydrolyzate from xture using brewer's yeast had a better and aroma than that from coconut toddy When the hydrolyzate was ripened by g in direct sunlight for about a week, as for fish sauce (Ling 1956), the product ed still further in aroma and became omparable to normal fish sauces.

Occasional batches of hydrolyzate were to develop a fungus growth on keeping. as distinct from the surface fungus which mes forms on supernatant oil layers and can be removed with the oil. Fungal and al growths on salt fish had been controlled additon of 2% citric acid in an investiga- ne at this station (Gunasekera, de Silva ntz 1959). The expedient of adding 2% acid to the hydrolyzate has proved effec- preventing these attacks of fungus.

The protein content of a preparation some indication as to its food value. In yzates, although the proteins have been down to amino acids, the total nitrougen t can be determined experimentally and he result the equivalent protein value may culated (A.O.A.C. 1950). Comparison of n values before and after processing will the degree of efficiency with which the n, and hence the food value, has been ved.

On analyzing an inital mixture of liver, salt and papain weighing 3500 grams, a en content equivalent to 14% protein was i.e. the mix contained approximately 500 of protein material. After processing, iquid obtained weighed 2900 grams (80% ry) and had a nitrogen content equivalent 7% protein i.e. it contained approximately ams of protein material. This shows that f the protein in the raw material was red in the final product and the value of protein in the hydrolyzate compares well he values between 9 and 16 obtained for s fish sauces. Other analytical values for drolyzate were total solid content = 22%; 6.5% and a pH of 5. When 2% citric acid dded the pH decreased to 3.3.

As the hydrolyzate is acid in nature the effect of neutralizing it was investigated. When neutralized by strong alkalies such as sodium hydroxide or carbonate, the hydrolyzate decomposed immediately. When lime was used there was slight decomposition but with magnesia or chalk the neutral hydrolyzate remained stable or over two months.

Neutralizing the hydrolyzate caused a loss in protein value as precipitation occurred making a further filtration necessary with consequent loss of material. After neutralizing with magnesia and filtering, the liquid retained only 70% of its original protein value while with chalk it retained only 45% of its original protein. It seems better therefore to use the hydrolyzate unneutralized as is done with fish sauces which are also acid in nature.

COMMERCIAL POSSIBILITIES

The equipment necessary to manufacture the hydrolyzate consists chiefly of acid-proof containers and filters, which in their simplest form could be glass jars and glass funnels. Very little labor is required as the main operations consist of mixing raw materials and filtering off the final product. Both liver and yeast are waste products, one from a liver oil plant and the other from a brewery. Salt is cheap and papain and citric acid though comparatively expensive are used only in small quantities. These factors are expected to keep down the cost of production of the hydrolyzate and make the process economically feasible.

Guttmann (1955) has analysed several hydrolyzates of fish livers and found them to have a high nutritional value, containing essential minerals as well as protein. Yeast hydrolyzates are also rich in protein and vitamins (Tauber 1949). Therefore a mixed liver and yeast hydrolyzate will form a valuable source of protein, minerals and vitamins (chiefly of the B-complex) which can be used as a supplement to the diet and in medicine.

The market possiblities of a food supplement are difficult to assess and will depend a great deal on advertisement. The sale of this product as a sauce will depend on how successfully it can be made to appeal to a public unfamiliar with fish sauces in general. There is also the possibility of using it to supplement

fish meals in animal feeding. This last outlet appears most suitable to start with and it is suggested that the hydrolyzate be sold along with or even added to fish meals.

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PRELIMINARY EXPERIMENTATION ON THE USE OF COCONUT OIL IN CANNED FISH AND THE SUITABILITY OF PROCESSING METHODS TO 307 × 409 CANS

by
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ABSTRACT

The main objective of these experiments was to find a suitable way of processing fish, ıg a certain size of can and locally available vegetable oils as medium.

Two species of fish were used in these experiments i.e. the "tembang" *(Clupea ɔriata C.V.)* and the "trakulu" *(Caranx sexfasciatus)*. Throughout the experiments 307 409 (20 oz.) cans were used, a size which is rarely employed for canning "tembang". onut oil was selected as medium because this oil is widely used for cooking purposes in ɔnesia. The oil was subjected to a refining process; the final product had an acid value .5, which was regarded necessary to prevent rancidity of the canned product. Some con- ents were used next to coconut oil, producing several sauces popular to domestic taste, i.e. pepper extract, "rudjak sauce, "bali" sauce, a mixture of dried red pepper and oil, and ndang ketjap" sauce. Tomato sauce was also used for comparison.

Results of these experiments have shown that a mixture of ground dried red pepper oil made a very good medium for fish canning, and is comparatively easier and cheaper repare.

In trying several processing methods for "tembang" it was found that precooking pared to drying and frying was more suitable for the type of cans used.

Two packs were tried in the canning of "trakulu" i.e. tuna-pack and mackerel-pack, it was also found that the use of a mixture of dried red pepper and oil was more desirable.

INTRODUCTION

The production of "tembang" *(Clupea a C.V.)* in Kota Baru (a place in East Kalimantan where a fish can- being established) has good prospects. hing grounds are not far, ranging from 3 miles from the shore. Beside that, h is comparatively cheaper and available nout the year.

The "tembang" dies instantly when . The meat is soft, weak and fatty. vhen still in a fairly fresh condition the round the abdominal scutes is already and when steamed well the meat will grate, especially of fish caught after feeding.

An experiment was also made with the lu", a *Carangid*, as this fish is a good sh and the production can be easily increased if special efforts are made. The "trakulu" has strong and tough dorsal lines and scutes, but steaming at atmospheric pressure for 20 minutes will remove them easily.

In preparing the sauces, red pepper was used as one of the main condiments, not only because it produces the typical hot taste highly regarded by the population, but also to attain an attractive color.

The main objective of these experiments is to find a suitable method of processing for certain fish in cans of certain size and form, and to find the most suitable combination of condiments for the sauce, using coconut oil as the main ingredient. Beside that, observations were made on the eventual reactions of the condiments with lacquor coating of the cans.

Due to unavailability of oval cans, which are commonly used in canning sardine-like

fishes, containers of the size 307 × 409 were used throughout these experiments.

To avoid undesirable results from the magnesium and calcium impurities of the salt found in the market, a special refining process was employed.

Experimental methods

The canned product was differentiated according to the species of fish, the kind of sauce and the method of processing used in each can. As mentioned before, the fish species used were "tembang" and "trakulu".

A. Sauces used

The kinds of sauce and the ways of preparing them are as follows:

1. Red pepper extract sauce

Red pepper	1 kg.
Salt, refined	100 g.
Cane sugar (plantation white)	100 g.
Coconut oil, refined	2 l.

About 500 ml. of oil was poured into a pan together with 1 kg. red pepper and heated well with continual agitation. After 30 minutes the required sugar and salt were added and dissolved in the mixture. The remaining part of the oil was added and the mixture was heated for another 30 minutes. The mixture was allowed to settle for one night at ordinary temperature, and the following day it was filtered through a cotton cloth and settled again for a few hours. Only the upper clear layer was used for canning.

2. "Rudjak" sauce.

Red pepper	1 kg.
Kemiri (nut of *Aleurites triloba*)	1 kg.
Onion (small, reddish violet)	500 g.
Garlic	50 g.
Salt, refined	200 g.
Cane sugar, plantation white	200 g.
Coconut oil, rich refined	4 l.
Celery leaf	about 10 g.
Laos (*Alpinia galanga* root)	about 20 g.
Vinegar	just to taste.

Just like the preparation of red pepper extract sauce, kemiri, onion and garlic were extracted with a small amount of oil for about 30 minutes. The remaining ingredients were then added, followed by the remaining oil and heated again for another 30 minutes. The mixture w lowed to settle for one night and scr through a fine cotton cloth and settled for a few hours. Only the upper clear was used for canning.

3. "Bali" sauce.

Red pepper	500
Onion (small, reddish violet)	250
Ketjap (sugar added to soy sauce)	100
Salt, refined	100
Cane sugar (plantation white)	100
Coconut oil, rich refined	2
Celery leaf	about 20
Salam (*Eugenia* sp.) leaf	3 l

The red pepper and onion were extr with hot oil. The other ingredients then added and heated for 30 minutes. mixture was allowed to settle overn screened and settled again. The upper layer was used for the experiment.

4. Tomato sauce.

Tomato juice (total solids 8%)	
Sugar, plantation white	6
Salt, refined	
Vinegar	
Onion, juice	
Clove	
Red pepper	
White pepper	

At first the tomato juice was heated to 60°C and the other ingredients were adde by one with continual agitation. The mixture was used for canning.

5. Mixture of dried red pepper and oil.

Dried red pepper	1
Coconut oil, refined	5
Cane sugar	to

The dried red pepper was reconstituted boiling water for 7 minutes, ground finel filtered. The ground red pepper was mixed with coconut oil in the proporti 1 g. of red pepper to 50 ml. of oil. The ture was heated with continuous agi and the sugar was added.

6. Pindang ketjap sauce.

Red pepper	
Onion (reddish violet)	
Garlic	

nir (root of *Curcuma longa*)	about 20 g.
tjap (sweet soy bean sauce)	20 g.
t, refined	20 g.
ery leaf	20 g.
am (*Eugenia* sp.) leaf	3 leaves.
os (root of *Alpinia galanga*)	10 g.
negar	10 g.
ter	1 l.

e ingredients were extracted in boiling for 20-30 minutes. The mixture was l and used for canning.

hods of processing the canned fish.

"Tembang" (*Clupea fimbriata* C.V.)

1. Dried method

The fish was eviscerated, washed and cut in container's length. Fairly sized fish (14-16 cm.) was beheaded, but smaller fish (7-9 cm.) was processed with head on.

The cleaned fish was immersed in a 100° salinometer brine prepared from refined salt for 15 minutes, and then dried for 4½ hours at a relative humidity of 70%. The dried product decreased in moisture content for about 24%.

The fish was filled into 307 × 409 cans; each can containing about 480 g. of fish. About 100 g. of hot (85°C) sauce was added into the cans, producing a gross weight of 680 g. each can.

The filled cans were exhausted at boiling water temperature for 15 minutes and immediately closed with a double seamer. Sterilization was done at 15 pound per square inch pressure (120°C) for 95 minutes.

Cooling after processing, was done in running water.

2. Fried method.

The fish was treated as in the dried method with the exception that it was fried after drying. The dried fish was fried by dipping in 105°C oil for 1 to 2 minutes according to the size of the fish.

After cooling by means of a fan, the fish was filled into cans, about 480 g. each can, which together with the added sauce made up a gross weight of 680 g. The filled cans was subjected to an exhaust at 95°C for 15 minutes and seamed immediately. The cans were sterilized at 120°C for 95 minutes, then cooled in running water from a faucet.

c. Precooking method.

The fish was eviscerated, immersed in 100° salinometer brine for 10-15 minutes, according to the size of the fish and then filled in cans. The filled cans were precooked at boiling water temperature for 30 minutes and the resulting liquor discarded. A certain degree of drying was achieved by passing hot air over the cans at 140°C for 10 minutes. Sauce was added afterwards and the cans were exhausted at boiling temperature for 15 minutes and sealed immediately. Processing was carried out at 120°C for 95 minutes followed by cooling in running water.

2. "Trakulu" (*Caranx sexfasciatus*).

a. Tuna pack.

The fish was beheaded and the viscera removed. About 10% of the initial whole fish weight was discarded through this action. The cleaned fish was steamed for 20 minutes at boiling water temperature, and then allowed to cool off for 14-16 hours. This cooling process made the flesh firm and easier to handle. The skin, bones, fins and tails were removed. The clean meat was sliced into half can length and filled in the cans. Sauce was added, followed by an exhaust for 15 minutes at boiling water temperature, after that the cans were sealed immediately. The cans were sterilized at 120°C for 95 minutes followed by cooling in running water.

b. Mackerel pack.

The beheaded and eviscerated fish was skinned, cut into container's length and washed thoroughly in clean water. The cleaned fish was dipped in a 10% brine for 20 minutes, filled into cans after sufficient draining and precooked at 95°C for 30 minutes. The resulting liquor was allowed to drain off. Sauce was added at about 95°C temperature.

The cans were then subjected to a 15 minutes exhaust and seamed immediately. Sterilization was done at 120°C for 95 minutes followed by water cooling.

Result and discussion.

As in the processing of sardine or mackerel, the canning of "tembang" has to be preceded by the lowering of the moisture content by means of sun drying or frying.

When sun drying is applied for this purpose, comparatively much labor is required. Moreover in a region with a high rainfall like Kalimantan, successful drying might not be obtained due to sudden rains. Results of this experiment have shown that it was also difficult to maintain an attractive appearance to the product because most of the fish was broken due to hand pressure during the filling operation.

The application of the frying method was faced with an economical difficulty, because oil prices are rather high in this country.

Precooking method has shown a better result, practical in operation and less laborious. It was also evident that bigger fish (mature) could give a better result than smaller fish.

The biggest problem in these experiments was that of obtaining "tembang" fish in a complete fresh condition. Although the fish was treated with ice immediately after capture and kept at temperature ranging from 0°C to 2°C, the condition still varied at the time of processing. A part of the batch was still completely fresh. but another part has completely lost its stiffness, and the belly wall was perforated.

With a properly controlled exhaust and addition of the sauce at a temperature of around 91°C, it was not difficult to obtain an average vacuum of 4 inches of Hg. (0.13 atm.) or even more.

Organoleptic test

About 500 cans of fish were subjected to organoleptic tests. The 500 cans were divided into 2 lots; one lot was stored for 2 weeks at room temperature, and the other for 2 months at the same temperature. The results of these tests is shown in Table 1 and 2.

As far as the taste is concerned, co oil is very promising for fish canning, but tunately it has a rather high solidification i.e. about 22°C.

The use of tomato sauce was not successful due to the difficulty in getting tomatoes with the required degree of ripen

The use of "pindang ketjap" sau packing "tembang" and "trakulu" prod nice product with an attractive taste and but the color of this sauce was objectio especially for higher class people.

One interesting fact was recorded canning of "tembang" using the precoc method, i.e. when opened after being stor 2 weeks at room temperature, the flavor product was not very attractive, whil texture was soft and it broke down easily the other hand, the same product when for 2 months at room temperature produ very palatable flavor, and the consistency flesh was firm, provided rough handli avoided during storage.

Tuna style canned "trakulu" pro an objectionable smoky flavor, especially stored for a longer period. Much care needed in packing to obtain an attra product. On the contrary, mackerel style p "trakulu" has a better and more attracti pearance and flavor. No chemical analysis be made on the experimental products.

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2 weeks in storage						2 months in storage					
Processing method	Medium	Flavor	Meat texture	Color	Comment	Processing method	Medium	Flavor	Meat texture	Color	Comments
Drying	Rudjak	inferior	mushy	pale yellow	Flavor of ingredients dominated by oil flavor	Drying	Rudjak	poor	pulpy and	pale yellow	Some spots detected on internal lacquer coating, also some indications of rusting especially in cans using tomato sauce.
	Bali	poor	,,	red desirable			Bali	,,	separated	undesirable	
	Red pepper extract	,,	,,	,,			Red pepper extract	,,	,,	,,	
	Tomato	good	,,	reddish pale			Tomato	excellent	,,	reddish pale	
	Red pepper mixture	fair	,,	good			Red pepper mixture	good	,,	good	
	Pindang ketjap	,,	,,	inferior			Pindang ketjap	,,	,,	inferior	
Frying	Rudjak	inferior	tough & separated	pale yellow	Flavor of ingredients dominated by oil flavor; Consistency of meat tough and hard to digest	Frying	Rudjak	poor	poor	pale yellow	
	Bali	poor	,,	red attractive			Bail	,,	,,	red attractive	
	Red pepper extract	,,	,,	,,			Red pepper extract	,,	,,	,,	
	Red pepper mixture	fair	,,	,,			Red pepper mixture	good	good	,,	
	Tomato	good	,,	reddish pale			Tomato	excellent	excellent	reddish pale	
	Pindang ketjap	,,	,,	inferior			Pindang ketjap	good	good	inferior	
Precooking	Rudjak	inferior	tender	pale yellow	Flavor of ingredients dominated by oil flavor; Meat consistency tender & easily become mushy, especially by rough handling	Precooking	Rukjak	fair	fair	pale yellow	Delicious Internal Lacquer affected; The firmness of the meat increased and palatable flavor developed
	Bali	poor	,,	red attractive			Bali	,,	,,	red attractive	
	Red pepper extract	,,	,,	,,			Red pepper extract	,,	,,	,,	
	Red pepper mixture	fair	,,	,,			Red pepper mixture	good	good	,,	
	Tomato	good	,,	reddish pale			Tomato	excellent	excellent	reddish pale	
	Pindang ketjap	,,	,,	inferiof			Pindang ketjap	,,	,,	inferior	

Table II. Results of organoleptic tests, showing the characteristic taste and appearance of canned "trakulu" *(Caranx sexfasciatus)*

Type of pack	Medium	Flavor	Meat texture	Color	Comment
	weeks in storage				
Tuna pack	Rudjak	objection-able smoky flavor	not soft	Yellowish pale	Flavor of ingredients dominated by smoky flavor
	Bali	,,	,,	Red attractive	
	Red pepper extract	,,	,,	,,	
	Tomato	,,	,,	Reddish pale	
	Red pepper mixture	,,	,,	Red attractive	
	Pindang ketjap	,,	,,	Inferior	
Mackerel pack	Budjak	Inferior	tender & good	pale yellow	Flavor of ingredients dominated by oil flavor; Fillets made good pack.
	Bali	poor	,,	red attractive	
	Red pepper extract	,,	,,	,,	
	Red pepper mixture	good	,,	,,	Meat sweet and palat-able
	Tomato	,,	,,	reddish pale	
	Pindang	,,	,,	inferior	
	2 months in storage				
Tuna pack	Rudjak	Very objection-able smoky flavor	not soft	yellowish pale	Edible but not desirable
	Bali	,,	,,	red attractive	
	Red pepper extract	,,	,,	,,	
	Tomato	,,	,,	reddish pale	
	Red pepper mixture	,,	,,	red attractive	
	Pindang ketjap	,,	,,	inferior	
Mackerel pack	Rudjak	Inferior	tender & good	pale yellow red	Fillets made good pack.
	Bali	poor	,,	red attractive	
	Red pepper extract	,,	,,	,,	
	Red pepper mixture	good	,,	,,	Meat sweet and palat-able
	Tomato	,,	,,	reddish pale	discoloration occured on lacquer coat-
	Pindang			inferior	

LOWERING THE SOLIDIFICATION POINT OF COCONUT OIL

by

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ABSTRACT

The suitability of coconut oil as packing medium in fish canning depends upon its lidification point. As coconut oil has already a considerable amount of mono and glycerides, the lowering of its solidification point can only be done by mixing with other inds of vegetable oils.

These experiments were made to ascertain which oils are suitable, According to ır data, rice bran oil will be the best, because a mixture of 10% can already drop the lidification point of coconut oil to 10°C, which is sufficient for Indonesia. Moreover this as high ∝ – tocopherol content.

INTRODUCTION

Canning of fish in Indonesia needs oil, pensive oil with a good taste. Coconut is very suitable, but its solidification is very high (22°C). In parts of the try, where the temperature may decrease by al degrees below 22°C, especially in the ing and evening hours, fish packed with ut oil, will become solid and not attractive ore when the cans are opened.

Though this difficulty can be eliminated eating the whole can, this will disturb mers sentiments. The popularity of the ed product will decrease considerably.

Since the solidification point of oils is not specific temperature, but is over a range of erature, as a result of mixed fatty acids in ent amounts and behavior, the solidifica- point may be considered as the temperature hich is reached an equilibrium between ced and lost heat. This point depends the crystallization and temperature in the ion.

In binary systems, the solidification will place several degrees below the melting , especially when these oils are mixed with kinds of oils.

MATERIALS AND METHODS

The equipment used for measuring the ification point, consists of a glass container cover, thermometer and electric stirrer. This container is filled with oil to be measured, and placed in a metal box. Between box and container is a thick layer of heat insulating material.

As refrigeration agent dry ice is used. During the observations the oil is mixed continously.

The beginning of cloudiness is taken as endpoint. Though this point is not exactly the solidification point, we may assume that oil in this condition is no more suitable for canning purposes. Cloudiness occurs when crystals begin to form, and separate from the solvent.

Coconut oil is mixed with glycerin, rice bran oil, soyabean oil, arachis oil, cottonseed oil and corn oil, which have a very much lower solidification point than coconut oil. All these oils are purified and freed from free fatty acids, but they are not winterized.

Glycerin shows a positive lowering and also cottonseed oil, though the latter cannot reach the zero point.

Soyabean oil, rice bran oil and corn oil have shown about the same effect, they are able to drop down the solidification point to 15°C, with an amount varying from 10% - 50%.

Peanut oil cannot make the solidification point lower than 5°C. Both glycerin and peanut oil make the mixture viscous. This viscocity will not be popular. Moreover, glycerin gives to the coconut oil a strange sweet taste.

Cottonseed oil and peanut oil do not affect the taste of coconut oil.

Rice bran oil gives a bran taste and odor, but has ∝ - tocopherol as antioxidant. With soyabean oil, rice bran oil has the advantage of lowering the solidification point of coconut oil down to 10°C even with 10% mixture. situation maintains till a mixture of 50 : 50

We may conclude that rice bran oi give the bests result not only according content of tocopherols, but also seen fro economical standpoint.

Data of this experiment are shown b

% Coconut oil	The beginning of cloudiness in coconut oil when mixed with: glycerin	cotton seed oil	peanut oil	soybean oil	rice bran oil	corn oil
100	22°C	22°C	22°C	22°C	22°C	22°C
90	20°C	20°C	19°C	15°C	10°C	16°C
80	17°C	19°C	16°C	15°C	10°C	15°C
70	15°C	18°C	13°C	15°C	10°C	15°C
60	12°C	17°C	11°C	15°C	10°C	15°C
50	10°C	15°C	9°C	15°C	9°C	15°C
40	7°C	13°C	7°C	10°C	7°C	13°C
30	3°C	10°C	6°C	5°C	5°C	8°C
20	− 3°C	7°C	5°C	1°C	0°C	1°C
10	− 10°C	4°C	5°C	− 7°C	− 4°C	− 8°C
0	− 20°C	0°C	5°C	− 9°C	− 6°C	− 12°C

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FISHERIES FINANCE IN JAPAN

by

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ABSTRACT

The paper first of all reviews the relative position of the fishing industry in the national economy from the point of view of the extent of its contribution to the national income as well as the amount of loans received from financial institutions.

Various sources of finance for the fishing industry and their relative importance are studied. Fishing enterprises are classified into three major groups, i.e. (1) family member enterprises, (2) medium and small-scale enterprises, and (3) large-scale enterprises. Financial requirements and the main sources of finance for each of the groups are explained, together with some problems to be solved and goverment financial measures to help family member-and small-scale fishing enterprises.

Position of Fisheries Finance in National Economy

Loans made by all types of financing institutions to the industries of Japan and outstanding at the end of 1956 amounted to 5,521.4 billion yen, of which 120.3 billion yen or 2.1 percent were those extended to the fishing industry.

Table 1 show the contribution of the fishing industry to the national income and the loans received by the fishing industry, as compared with other sectors of primary industries.

Table 1. Position of the Fishing Industry in National Income and Total Loans made by Financial Institutions.

Economic Activity	National income 1		Loans made by financial institutions 2	
	... Amount ...		... Amount ...	
	(billion yen)	%	(billion yen)	%
Total	7,568.9	100.0	5,521.4	100.0
Primary industries	1,444.0	19.1	446.4	8.1
Agriculture	1,078.8	14.3	297.3	5.4
Forestry	175.2	2.3	28.8	0.5
Fisheries	190.0	2.5	120.3	2.1
Secondary and Tertiary industries	6,124.9	80.9	5,075.0	91.9

1 National Income for the year April 1956 to March 1957

2 Financing institutions also include governmental financing institutions.

It should be noted that the contribution of secondary and tertiary industries to the national income is much greater than that of primary industries, i.e. eighty-one percent as against nineteen percent.

The loans made by financial institutions to primary industries amount to only 8.1 percent of the total loan made to all industries. Seventy-four percent of the total income of primary industries comes from agriculture and thirteen percent from fisheries. As to the amount of loans made by financing institutions to the two industries, 67 percent of the total goes to agriculture and 26 percent to fisheries. This indicates that comparatively larger amounts of loans are available to the fisheries in relation to their contribution to the national income.

2. Sources of Finance to the Fishing Industry

Finance to the fishing industry may be divided into four types:

1) Commercial bank finance
2) Cooperative finance
3) Governmental finance, and
4) Non-institutional finance.

Commercial banks comprise city and local banks. They extend loans primarily to the enterprises in any section of the industries which have good financial standing. In the field of fisheries, only a limited number of larger fishing enterprises with good financial standing has access to such loans.

Credit cooperatives are mutual financing institutions. The system consists of a) local fishery cooperatives; b) prefectural credit federations of local fishery cooperatives; and c) the Central Cooperative Bank for Agriculture and Forestry. Loans for working or equipment funds are extended by these cooperative financing institutions to member fishermen as well as to member cooperatives.

Governmental finance supplies long-term loans at low interest to fisheries operators for construction of boats and for other equi purposes. Governmental finance plays a the national policy of fostering developm the fishing industry. There are two governmental financing institutions, i.e.

1) Agriculture, Forestry and Fis Financing Corporation, and

2) Japan Development Bank.

Loans by the Agriculture, Forestr Fisheries Financing Corporation are primarily to small and medium-scale fish or enterprises, while the Japan Develo Bank supplies long-term loans to compara large-scale fishing enterprises.

The three types of finance men have specific activities but at the same their functions are complementary t another. Small-scale fishermen whose fin standing is generally poor, rely main cooperative and governmental finance. Ho due to shortage of funds available to thes financial institutions, they are often obli borrow money from non-institutional fina sources such as wholesalers, brokers, proce pawn shops, usurers, relatives and friends terms of loan from these sources are in cases disadvantageous.

The relative importance of these types of financing facilities in the f industry is shown in Table 2.

As indicated in Table 2, amoun money financed by banks including both and short-term loans constitute 46 perce the total, those by cooperative financing in tions 15 percent, those by governmental f ing institutions 12 percent and those by institutional sources 17.5 percent. Ho in terms of number of single loans, constitute 24.7 percent of the total. The it should be noted that the amount pe is comparatively high in the case of comm banks. It should also be noted that Government loans are granted only for bu or equipment purposes, the amount of p per loan is rather high.

Table 2. Financing Facilities and their Relative Importance in the Fishing Industry 1952

	Percentage of amount	Percentage of number of loans
otal	100.0	100.0
on-governmental financing institutions	70.4	51.2
anks	46.2	24.7
ooperative financing institutions	15.0	17.5
ther small facilities (mutual financing banks, credit banks)	9.2	8.9
overnmental financing institutions	12.1	2.2
on-institutional financing facilities	17.5	46.6
lutual financing associations	0.7	6.0
awnshops, usuries	1.0	2.3
holesalers, brokers, processors	2.6	6.9
hipbuilders, material suppliers	2.1	1.9
elatives, friends	7.0	23.8
thers	4.1	5.6

SOURCE: The figures are taken from the report of a survey conducted by the Fisheries Agency in 1952. The survey was based on 1,900 loan cases.

shing Enterprises of Different Scales and eir Financial Sources

Fishing enterprises are divided into three classes:

(1) Family-member enterprises with vessel of less than 10 tons. These usually employ only own family labour.

(2) Medium and small-scale enterprises with vessel of more than 10 tons.

(3) Large-scale enterprises. (Five companies with big capital).

In Table 3, the fishing enterprises are classified according to size of the vessels operated. The classes are further grouped into the three categories mentioned above. The table also indicates the average size and structure of the assets of enterprises of various classes. It should be noted that the proportion of borrowed funds and owned funds differs from class to class. The bigger the scale of operation, the greater the funds borrowed.

Table 3. Structure of Assets of Fishing Enterprises

Type of enterprise	Type of vessel operated	Assets	Borrowed funds	Owned funds	Number enterpri
		(1000 yen)	%	%	
Family member	Non-powered craft	470	10	90	
	Powered craft				... 239,213
	2 tons and less	740	9	91	
	3—10 tons	1,400	14	86	
Medium and small-scale	11—30 tons	3,650	27	73	
	31—50 ,,	8,920	39	61	
	51—100 ,,	19,450	39	61	... 12,529
	101—200 ,,	38,250	64	36	
	201 tons and above	114,590	76	24	
Large-scale		2,700,000	79	21	... 5

SOURCES : Figures on assets have been taken from the reports on the Fisheries Economic S of the Ministry of Agriculture and Forestry and from financial reports of the com Figures on number of enterprises have been taken from the results of the Fis Census in 1954.

(1) Family-member enterprises

Family-member enterprises amount to about 95 percent of the total number of fishing enterprises in Japan. Operations are conducted mainly by the family members and productivity is very low. They also rely on farming and other side-job incomes. In selling their catches, the fishermen very often rely on specific marketing outlets which guarantee prices thus enabling them to continue their activities.

The amount of money borrowed by individual family-member fishermen is small. According to the survey made by the Ministry of Agriculture and Forestry, the major part of loans comes from non-institutional financing sources such as relatives, friends, wholesalers, and processors. Loans are also extended to them by fishery cooperatives but very few loans are available from commercial banks and governmental financing institutions.

The same survey revealed that about 40 percent of the total loans was used for production purposes while the rest went in living expenses and taxes.

(2) Medium and Small-scale Fi Enterprises

Medium and small-scale fishing prises make up five percent of total enterprises, but their production consti considerable part of the Japanese total Their fishing operation is conducted mo hired labour. Most of these enterprise been engaged for a long time in off-sh high-seas fisheries and possess compar large capital. However, their operation re a considerable amount of capital and th they rely to a large extent on borrowi seen from Table 3.

Equipment funds are provided ma the Agricultural, Forestry and Fisheries F Corporation, a Government credit insti and the Central Cooperative Bank for A ture and Forestry. (These two insti extended 76 percent of the total equ loans to medium and small-scale fishing prises in 1959).

This class of enterprises receives 60 percent of total working fund loans ex to the whole fishing industry. Main s

ommercial banks, mutual banks and fishery ratives.

Large-scale Fishing Enterprises

Large-scale fishing enterprises in Japan st of five big fishing companies which are ed in pelagic and factory-ship fishing as Antarctic whaling, salmon in the North c and tuna fishing in the Pacific and Indian n. Most of them are also engaged in ice ng, refrigeration, and canning. Their ess is stable and enjoys credit with banking utions.

The loans to these five companies con- ed 56.6 percent of total equipment funds ded in 1956 to the whole fishing try. The loans also include those ex- d by the Japan Development Bank which overnmental banking institution, but there eneral tendency of gradual decrease in the ntage of governmental finance as compared the fisheries rehabilitation period im- itely after the Second World War. Most e loans come from "long-term credit s" and "trust banks" which are not easily sible to medium and small-scale fishing prises.

About 35 percent of the total working lent to the fishing industry are extended e five big companies. The major part is ded by commercial banks.

Some Problmes and Government Measures in Fisheries Finance

Larger fishing enterprises enjoy a more rable position in obtaining funds for ment and for working purposes than small- fishing enterprises which often have to to non-institutional financing facili- Some fishing enterprises may borrow y from their relatives or friends without st but the terms of most non-institutional are disadvantageous to the borrowers.

Much improvement has been made in cing small fishing enterprises through the rative banking system. Loans are extended by the Central Cooperative Bank to local cooperative which in turn lend money to their members. However, here again it is difficult for cooperatives to extend loans to members whose operating scale is small and whose financial standing is poor. In the circumstances it is necessary for small-scale fishermen to improve their financial standing through increased production and at the same time fishery cooperatives have to improve their financial standing so that the cooperative banking system may operate smoothly.

To facilitate the financing of small-scale fishing enterprises:

(1) The Government has instituted a loan guarantee system primarily for small-scale fishing enterprises. This system was established in 1952 and has facilitated cooperative credit, although this guarantee can also he applied to credit institutions other than cooperatives.

Loans extended to medium and small-scale fishing enterprises by financial institutions are guaranteed by Prefectural Fisheries Loan Guarantee Fund Associations which were established on the basis of contributions made mainly by fishery cooperatives and local governments. Furthermore, the risk borne by the financing institution is covered by the Central Government which reinsures the prefectural guarantee associations.

(2) The Government has undertaken, under the Reconstruction and Consolidation Law for Agriculture, Forestry and Fishery Cooperative Associations, to give assistance to cooperatives of poor financial standing. The assistance includes subsidy in proportion of the increase of share capital and also subsidy in proportion of the interest paid by the cooperatives.

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